Students' Identification with Discursive Obligations in a Calculus Workshop

by

TIMOTHY M. STOELINGA B.S.G.E., University of Illinois at Urbana/Champaign, 1991 M.Ed., Loyola University Chicago, 2000

DISSERTATION

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Defense Committee: Dr. Danny B. Martin, Chair and Advisor Dr. Gregory V. Larnell, Curriculum & Instruction Dr. Joshua Radinsky, Curriculum & Instruction and Learning Sciences Dr. Melissa Gresalfi, Peabody College of Education and Human Development, Vanderbilt University Dr. Edd V. Taylor, School of Education, University of Colorado This thesis is dedicated to Evie and Isaac, my two greatest teachers.

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LIST OF ABBREVIATIONS

AY	Academic Year
DO	Discursive Obligation
ESP	Emerging Scholars Program
IRF	Identity-related Factor
LPP	Legitimate Peripheral Participation
LSRI	Learning Sciences Research Institute
PDP	Professional Development Program
STEM	Science, Technology, Engineering, and Mathematics
UIC	University of Illinois at Chicago

SUMMARY

Research on equity in mathematics education has documented the benefits of group work and classroom discourse, both of which can support learning of mathematics content (e.g., Freeman, et al., 2014; Kilpatrick, Swafford, & Findell, 2001; Webb, 2009; Webb, et al., 2013) and the development of identities of participation among students in discourse-rich classroom environments (e.g., Boaler, 2002; Boaler & Greeno, 2000; Cobb, Stephan, & Gravemeijer, 2001; Gresalfi, 2009; Gutiérrez, 2002; Hand & Gresalfi, 2015). Less is known, however, about how and why individual students take up opportunities to participate in classroom discourse, and why individual and situational differences in participation arise within a given mathematics classroom ecology in which mathematical discourse is normative. These issues are particularly salient for students of color and female students whose marginalization from mathematics classroom discourse has been well documented in the literature (e.g., Chizhik, 2001; Cohen & Lotan, 2014; Rubin, 2003; Steele, Spencer, & Aronson, 2002)

In this phenomenological case study, I examine a diverse group of students' descriptions and explanations of their participation in discourse in an Emerging Scholars Program (ESP) calculus workshop, an undergraduate-level, elective course where group work is emphasized in support of students' success in the concurrent required Calculus I course. From students' descriptions I generate a localized, explanatory theory for the individual and situational patterns and differences in discourse participation that emerge. The theory emerges from within a sociocultural framing of identity, where instances of discourse are viewed in terms of students' identifications with discursive obligations, defined by the socially constructed norms of what it means to be a successful contributor to mathematical conversations in the workshop community. Identification, in turn, is operationalized as students' fulfillment (or non-

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fulfillment) of these obligations occurring in modes of affiliation, compliance, avoidance, or resistance.

I study the phenomenon of identification by documenting individual variations and patterns indicated in students' stimulated recall of micro-level, moment-to-moment discursive interactions. Variations in identification modes within and between students are primarily explained in terms of the temporary, situational roles students describe themselves occupying relative to other participants in workshop discourse. Furthermore, students often interpret these roles in connection to identity-related factors acting at sociohistorical, community, school, classroom, and intrapersonal levels (Martin, 2000, 2012). Implications for ESP workshop design and classroom discourse in general are discussed, with a particular focus on implications for supporting equitable mathematics discourse in workshop settings among students from marginalized groups. In addition, leveraging students' perspectives through stimulated recall is presented as a viable methodological approach to exploration of the interconnections between students' negotiation of multi-level identifies across various contexts and communities and their micro-level identifications with classroom discourse.

CHAPTER I. INTRODUCTION

It is 1:30 in the afternoon, thirty minutes into a two-hour, twice-weekly, elective calculus workshop for university undergraduates. In the workshop classroom, a small, diverse (by race, ethnicity, and gender) group of students are working on a challenging set of calculus problems after having been asked by the instructor to "work together and talk about your solutions with each other." Near the door, three students are huddled over their notebooks, two of them verbally resolving a discrepancy in their written work and the third looking on but not speaking. On the other side of the room, one pair of students sits facing each other, one silently writing in a notebook, one sitting with chin in hand looking down but not writing. By the windows another group of three sit shoulder-to-shoulder, with one student explaining to another how to solve one of the problems while the third looks elsewhere. At the front of the room, the instructor and a student discuss a graph for one of the problems on the blackboard.

A week later in the same workshop during a similar activity the workshop has a similar feel, but there are differences as well. One student, who was contributing to the conversation a week ago, is now working independently on a problem separately from her group mates' conversation about a possible solution. Another student who worked silently and independently from his partner a week ago is now in another group, asking questions and speaking often. Still others seem to contribute—or not contribute—to conversations similarly to the ways they did the previous week. Later in the workshop session, a typically reserved student volunteers to work aloud through a solution at the board with the whole class. Later still, another student writes an elegant solution on the board but slides back into her seat afterward, seemingly to avoid explaining the solution to the whole class.

The calculus workshop in which these students were participating is part of the Emerging Scholars Program (ESP), an academic support structure implemented widely in post-secondary STEM programs across the nation. The ESP workshops provide an academically rich setting in which students work collaboratively to learn major concepts in concurrent "gatekeeper" mathematics and science courses. The program is targeted toward enhancing academic success specifically (though not exclusively) for students historically marginalized in STEM fields because of race, ethnicity, and gender. Collaborative work is emphasized in the design of the workshops as a way to foster mathematical conversations that support conceptual understandings, as well as to provide opportunities for positive socialization into an academic community that might not otherwise be available to students.

Viewed as a snapshot of one particular ESP workshop, the vignette above illustrates students collectively "working together and talking about problems" in a way that may be understood at some level as aligning with the request of the instructor and the broader design principles of ESP. From a surface view of this workshop, collaboration and communication among participants was occurring in these moments. Individually, however, students were taking up—or not taking up—these requests in very different ways from one another, and in ways that appeared to vary from one instance to the next. The vignette begins to illustrate a broader phenomenon in the calculus workshop: in a context where student discourse was normative at some level, there were both individual and situational differences in the ways students participated in discourse.

If the request of the instructor to engage in mathematical conversation was more than a hopeful suggestion for students to talk about mathematics from time to time, or more than an intermittent attempt to enact a particular design feature of the workshop—if in fact it represented an important part of the fabric of the workshop community itself—then the ways students

participate in conversations are consequential to the identities they develop and the opportunities they will have to learn mathematics within the workshop as it has been constructed by this community. Participation in mathematical conversations then becomes a way for students to become woven into the social and mathematical fabric of the workshop community, and thus to leverage the benefits it affords. If and as participation in conversation varies by student and by situation, it follows that some students may benefit from the workshop more than other students, and in some situations more than in other situations.

Much of the discussion in the literature related to mathematics classroom discourse-which I define here as conversations directed toward mathematical reasoning and problem-solving provides evidence that classroom discourse supports students' cognitive understanding of mathematical concepts (e.g., Kilpatrick, Swafford, & Findell, 2001; Webb & Palinscar, 1996). From a sociocultural perspective, classroom environments characterized by norms of collaboration and discourse have been found to make identities of participation in mathematics classroom communities more available to students (e.g., Boaler, 2002; Boaler & Greeno, 2000; Cobb, Gresalfi, & Hodge, 2009; Cobb, Stephan, & Gravemeijer, 2001; Gutiérrez, 2002). Yet while such discursive environments are generally shown to support mathematics learning and identities of participation at the classroom level, there is also evidence that this is not equally the case for all students within a given classroom community (e.g., Chizhik, 2001; Cohen & Lotan, 1997; Rubin, 2003; Steele, Spencer, & Aronson, 2002). The literature has explored this oftenseen inequity of access in relation to a range of complex sociological, sociopolitical, ecological, and disciplinary factors. These factors have been convincingly shown to influence the kinds of participative identities that are made available (or unavailable) to students in various settings. Less is known, however, about how individual students negotiate these various and complex

factors in ways that may influence their moment-to-moment participation in discourse. Relatedly, there has been limited research about how students interpret and make sense of their own participation in relation to these factors. In this dissertation, I explore students' own interpretations of how and why they participate in workshop discourse in the particular ways they do, with the intention of generating an emergent theory for explaining the individual and situational differences that occur among students in the workshop.

I hold as a basic premise that these differences can ultimately be consequential to students' success or failure in the workshop, and thus may be consequential to success or failure in the concurrent calculus course and in students' academic trajectories beyond. Enhancing understanding of how and why such differences emerge among students in the same classroom ecology can contribute not only to addressing inequities among individual students' opportunities to learn in ESP workshops, but may also further understanding in the field about equitable access to identities students are able to develop through mathematics classroom discourse.

The ESP workshop is a uniquely appropriate and interesting context in which to study discourse in this way. The workshop represents a context that is intentionally designed to foster discourse in order to enhance students' cognitive mathematics understandings as well as their socialization into a mathematics learning community. The original founders of the workshop model conceptualized a set of supports intended to help more African American students successfully complete the required coursework in STEM majors. The model introduced students to an academic socialization structure that prioritizes problem-solving, collaboration, and discourse in an informal workshop. Rather than providing remediation, the workshop addressed rigorous content related to the concurrent calculus course. On the one hand, the design suggests

that opportunities for discourse would be prevalent in the workshop, providing a rich source of data from which to draw. On the other hand, the design intention of fostering discourse in support of marginalized students' success allows for further examination, problematization, and nuancing of some of the premises and assumptions incorporated into the design. That is, as I explore students' own interpretations of how and why they participate in workshop discourse in the particular ways they do, I do so with the added aim of comparing students' (and particularly students' from marginalized groups) interpretations of their own experiences in relation to the intentions of the ESP design.

Foundational Conceptualizations

Explaining differences in students' discourse participation presents empirical challenges based on the complexities involved in empirically interpreting participation. One instance of discourse participation may look similar to another in observation, but each may represent fundamentally different enactments of identity within the workshop community. For example, one student may engage in discourse to provide help to another student based solely on explicit instructions to do so, whereas another student may do so out of a desire to be helpful, or else to "learn by teaching." Similarly, participation in discourse can often appear outwardly as nonparticipation, as with a student who engages in active listening but makes few verbal contributions. Furthermore, workshop discourse itself needs to be conceptualized clearly if differences in participation in discourse among students and in varying situations are to be interpreted and understood.

To address both of these issues, in this dissertation I conceptualize *identification with discursive obligations* as a way to address these interpretive challenges. This conceptualization

draws from an interpretive scheme developed by Cobb, Gresalfi, & Hodge (2009) for analyzing identities in mathematics classrooms. In my adaptation of this scheme, *discursive obligations* reflect the normative expectations of workshop communication among participants in the context of solving problems and discussing solutions to problems collaboratively. Specifically, obligations represent what it means to a student to successfully engage in workshop discourse as constituted by the workshop community. *Identification* refers to students' fulfillment (or non-fulfillment) of these discursive obligations, as well as their internal organization of thoughts, feelings, and sense of self in relation to the obligation across students and situations can be interpreted by analyzing students' moment-to-moment modes of identification with discursive obligations in the workshop. Because these modes are in part defined by the individual's internal thoughts, feelings, and sense of self with respect to obligations, students' perspectives are the privileged vantage point for examining identification, primarily revealed through students' own interpretations and explanation of their participation in discourse.

To then further explore *why* students identify with discursive obligations as they do, I introduce a multi-level approach adapted from Martin's (2000, 2012) multi-level framework for analyzing identity, generalized from Martin's development of the framework for analyzing African Americans' development of mathematics identities. In this approach, students' reflections about workshop discourse are mined for *identity-related factors* students invoke as they interpret their own participation *post hoc*. Identity-related factors represent the narrated events, experiences, and self-understandings associated with identity enactments at the sociocategorical, community, academic/disciplinary, classroom, and intrapersonal levels. Here I define the *sociocategorical level* in connection to Martin's (2000) *sociohistorical level*,

specifically as it relates to students' *socially constructed identities* with respect to "social categories—including, but not limited to race, ethnic, or gender categories—that are often imposed on people within a particular context" (Esmonde, et al., 2009, p. 20).

The purpose of this multi-level approach is to understand which factors at what levels are salient in students' identification with discourse in micro-level, moment-to-moment interactions. For example, by design the ESP workshop is geared toward providing a diverse, equitable, rigorous learning environment specifically though not exclusively intended for students from historically marginalized groups. A multi-level approach can shed light on if and how students invoke their socially assigned racial, ethnic, and gender categories as salient to their identification with workshop discourse: that is, do students connect their identities and experiences related to these social categories to their identification with workshop discourse in their post hoc reflections on workshop discourse, and if so how? Or else how do students invoke influences related to their social communities outside of the classroom, to academics, to the discipline of mathematics, to the classroom community itself, as well as to their internalized views of themselves? Such exploration is intended to document which levels are invoked as having more influence in discursive instances, and for which students. Overall, this approach is intended to enhance understandings about the interplay between students' identification with workshop discourse and various levels of identity enactment across the range of students' lives both inside and outside of the workshop, as a way to explain individual and situational differences in identification with discourse in the workshop.

Guiding Questions

In this dissertation, I pose as a thesis that individual and situational differences in students' participation in workshop discourse are interpretable in terms of students' identification with discursive obligations, and can be further explained through the connections students make between workshop discourse and identity-related factors acting at various levels in their lives. My exploration of this thesis will be guided by the following questions:

- How do students describe their *identification* in moment-to-moment instances of discourse?
 - a. What modes of identification do students describe with the *discursive obligations* in the workshop?
 - b. What patterns or variations emerge in identification across students, situations, and/or particular discursive obligations in the workshop?
- 2) What *identity-related factors* are invoked in students' explanations of their identification with workshop discourse?
 - a. What patterns or variations emerge in how factors at various levels (i.e., social categories, external communities, academic and disciplinary, classroom community, and intrapersonal) influence students' identification?
 - b. How do these factors account for individual and situational differences in identification?
 - c. How do students invoke these factors to make sense of their own participation in workshop discourse?

To address these questions, some initial empirical groundwork needs to be laid. There is a premise integrated into these questions that workshop discourse can be interpreted in terms of

discursive obligations, and further, that students do demonstrate these various modes of identification with these obligations. In a sense, this presumption forms an analytical foundation of the study, and needs to be examined empirically as for the workshop as the initial step of inquiry. The first question addresses this issue, and then begins to probe at broad patterns and variations that may emerge relative to students' identification with discursive obligations across the workshop as a whole. The second question pushes toward an understanding of why these patterns and variations may exist, specifically in terms of identity-related factors. This question will be analyzed both at the workshop level to identify factors that may be common to workshop participants collectively, and at the individual student level to further explain individual differences, as well as to understand how students negotiate these factors in ways that are meaningful to their identification with workshop discourse.

Organization of the Dissertation

I begin this exploration in Chapter II by discussing the connection between mathematics discourse and learning in the literature, in part to demonstrate discourse in mathematics classrooms as an important topic for empirical study, and in part to explore research on equitable opportunities to learn through discourse. Mathematics education research approaches the connection between discourse and learning from two primary orientations: as influencing cognitive proficiency in disciplinary practices, and as influencing students' construction of identities of participation within a mathematics classroom community. From both perspectives, discourse is viewed as instrumental to learning; however, discourse alone does not guarantee that students will learn. Factors related to classroom ecologies, status and positioning, group composition, and tasks have all been documented as influencing students' opportunities to learn

through discourse. I highlight each of these factors as a prologue to my own analysis of how workshop students navigate and interpret these each of these factors as part of their identification with discursive opportunities. I then turn to a more detailed summary of a smaller body of research that privileges the learner's perspective in examining mathematics classroom discourse. Here I also turn to a strand of research external to mathematics education research related to how second-language learners "invest" in discursive opportunities, suggesting an empirical approach to studying classroom identity that deeply considers how participants' identities both inside and outside of the classroom intersect with each other. I conclude my review by summarizing a body of literature specific to the role of discourse in ESP workshops, with a particular focus on aspects of the design, philosophy, and empirical accounts related to collaboration and group work in the program.

I conduct this study primarily from a perspective of situated learning. In Chapter III, I briefly discuss situated learning and its roots in sociocultural theory as an overarching framework for understanding identity development in mathematics classroom ecologies. I highlight particularly relevant literature that offers views of how classroom discourse relates to students' identity development in mathematics. I then establish the basis in the literature for my own theoretical model, drawing from the following frameworks:

- An interpretive scheme for analyzing mathematics classroom identities. Drawing from this scheme developed by Cobb, Gresalfi, & Hodge (2009) I adapt a framework for analyzing students' identification with discursive obligations.
- *Positioning theory*. As some early foreshadowing, my analysis eventually leads to the emergence of *positioning* as a preeminent factor in students' accounts of discourse, which

I then unpack in more detail in Chapters VI and VII. I therefore describe in Chapter III a framework for positioning (Bucholz & Hall, 2005).

Multimembership and multi-level approaches to identity. As a framework to organize and interpret the factors students raise in their explanations of discourse, I describe an approach to identity development within a mathematics community as being mutually influenced by one's *multimembership* in various other communities of practice (Wenger, 1998), and as developing through mathematics socialization as it occurs at sociohistorical, community, school, and individual levels (Martin, 2000, 2012).

I conclude the chapter by introducing an initial theoretical model that brings these frameworks together and defines the constructs of interest in each. In the model I depict a relationship among discursive obligations, students' modes of identification with discursive obligations, and the identity-related factors the students invoke in their self-descriptions of their participation in workshop discourse.

With these theoretical and analytical framings, the table is set for the empirical work described in Chapters IV through VII. The research methods and design of this project as a qualitative, phenomenological case study are described in Chapter IV. As illustrated in Figure 1.1, results are detailed in these three chapters (V, VI, and VII), with each chapter adding an iterative layer of analysis based on the emergent findings of the previous analysis. Chapter V lays the groundwork for the more exploratory analysis to follow. This groundwork consists of empirically establishing what discursive obligations students described in the workshop, what modes of identification they described (and how often) with those obligations, and how identification modes aligned with obligations. In Chapter VI, the analysis moves toward examining *why* students identified with discursive instances as they did, based on the identity-

related factors they invoked in their *post hoc* descriptions. From this analysis, patterns emerged suggesting the salience of students' interpretations of their own *positioning* in discourse, prompting a deeper exploration into how the temporary roles students described for themselves influenced their identification with discursive instances, from which further patterns emerged.



Figure 1.1. Schematic of analysis in Chapters V, VI, and VII.

In Chapter VII, a set of three individual student subcases provides a more detailed analysis of how these situational roles intersected with other, less-frequently invoked factors. The "subcase" students—all from marginalized groups—demonstrate at a finer grain size how identity-related factors, positioning (in the form of temporary roles), and identification with discourse all mutually influenced one another. The chapter concludes with an overview of common patterns and important differences among these three students.

I conclude the dissertation in Chapter VIII with a broad summary of key findings and interpretations from both the workshop-level and individual subcase analyses, organized by the guiding questions for the project. I highlight aspects of and assumptions in the ESP design that are supported by this case study, and that might be further problematized. I also discuss implications for implementation of ESP workshops, which may also be applied to mathematical learning contexts more broadly with full attention to contextual differences and to the selfcontained nature of this research as a case study. Suggestions for further research are offered as well.

CHAPTER II. REVIEW OF RELEVANT LITERATURE

One of the core design principles of the ESP workshop is to facilitate mathematical communication among students.

[Workshops are intended] to foster conversations in which the students have to articulate their own mathematical ideas and listen to the mathematical ideas of others. The instructor, in the role of facilitator, proceeds from those conversations to pose questions, to challenge students' ideas, and to prompt them to think harder about the mathematics (Asera, 2001, p. 15).

The rationale for establishing a discourse-rich environment in the workshops is two-fold. First, the design is intended to enhance cognitive mathematical understandings through the formulation, articulation, and refinement of ideas that occurs through mathematical conversation (Hsu, Murphy, & Treisman, 2008). Second, the design is intended to provide opportunities for socialization into a diverse academic community, particularly for students historically marginalized in STEM programs by race and ethnicity (Treisman & Asera, 1990).

I begin this chapter with a targeted discussion of the mathematics education literature related to classroom discourse as it has been promoted in reform-based initiatives over the past several decades. I first discuss some of the connections drawn in the literature between discourse and mathematics content learning (related to the first rationale) with attention to the conditions that are found to be most salient to students' equitable opportunities to learn content through discourse. I then turn to the second rationale, focusing on literature related to students' socialization into mathematics classroom communities, specifically focusing on the conditions and factors that influence students' opportunities to enact identities through discourse within a mathematics classroom community. This review provides the context in the literature for exploration into how students in the present study experience these conditions as salient to their participation in workshop discourse.

I then turn toward a discussion of literature that helps to situate my study within research that specifically privileges the learner's perspective in examining mathematics classroom discourse. Here I rely on a relatively small number of studies that focus on how students interpret their participation in discourse. This research explores the ways students enact identities related to discourse, where their own perspectives are instrumental toward understanding what kinds of factors are most meaningful to students in those enactments. These studies conducted in K-12 settings provide a launch point for my own inquiry into the post-secondary context where research on classroom discourse is sparse, but where fostering discourse is an essential aspect of the design of ESP workshops. A focus on the learner's perspective provides a perspective from which to explore and problematize the design against the narrated experiences of participants. To round out this exploration of learners' perspectives, I reach outside of mathematics education to a strand of research on how second-language learners "invest" in opportunities to engage in discourse-based learning. While I did not incorporate the construct of investment per se into my own study, I explore it briefly as an empirical perspective for studying classroom identity in a way that deeply considers identity enactments both inside and outside of the classroom-a central theme in my examination of students' identification with discursive obligations in the ESP workshop.

The review then turns to another relatively small body of literature specific to the role of discourse in ESP workshops. Here I provide an introductory, literature-based background of the history, design, and philosophy of ESP, with particular attention to literature that describes the role of collaboration and discourse in the workshop design. Empirical studies of ESP are primarily limited to accounts of implementation structures and supports, and quantitative studies of outcome measures, which I summarize briefly. A notable exception is found in an extensive

case study of an ESP workshop (Oppland, 2010; Oppland-Cordell & Martin, 2014). I conclude the chapter with a brief discussion of this case study, which represents the first significant strides toward understanding students' socialization and identity enactments in the workshop.

The present study focuses on students' identities as they are constructed in relation to the discourse within a calculus workshop community, but which interact with students' histories, experiences, and identities as constructed in their lives more broadly as well. As such, I conclude the chapter by describing three key considerations related to identity that are particularly useful in this regard: 1) identity as related to membership and participation in a community of practice, 2) identification as representing the modes by which students fulfill obligations of the community, and 3) the interplay of identity enactments across multiple memberships and hierarchical levels. These conceptualizations related to identity constitute the key theoretical frameworks I adopt for the study, and formulate the basis of an initial theoretical model I will propose to structure my overall analysis of students' identification with workshop discourse.

Discourse in Mathematics Classrooms

One of the primary concerns in mathematics reform over the past three decades has been the integration of mathematical communication into the goals and activities of mathematics classrooms (e.g., Kilpatrick, Swafford, & Findell, 2001; National Council of Teachers of Mathematics, 2000; National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). Mathematical communication is constituted in classroom practice as occurring through structures of whole-class discussion, group work, and teachers' implementation of collaborative and cooperative learning strategies (de Corte, 2004). In relation to verbal communication, there are generally two distinct rationale for creating discursive

mathematical learning environments: the first stems from a largely cognitive perspective on the connection between communication and the learning of mathematics content (e.g., Antil, Jenkins, Wayne, & Vadasy, 1998; Lerman, 2000, Rogoff, 1990; Schoenfeld, 2002; Webb & Palinscar, 1996; Zakaria, et al., 2014); the second involves a sociocultural perspective in which social discourse is the means for constructing *identities* related to the classroom community and the discipline of mathematics (e.g., Bielaczyc, Kapur, & Collins, 2013; Boaler & Greeno, 2000; Gresalfi, Martin, Hand, & Greeno, 2009; Rogoff, 2003).

Discourse and the learning of mathematics content

The affordances discourse provides toward students' cognitive learning of mathematics content are well documented. There is empirical evidence, for example, that students develop understanding of mathematical concepts from listening to and watching their peers (Azmitia, 1988) and teaching their peers in discursive situations (e.g., Brown & Palinscar, 1989; Cooper & Slavin, 2001; Freeman, et al., 2014; Jackson, Kirabo, & Bruegmann, 2009; Stevens & Slavin, 1995; Webb, 1991, 2009; Webb, et al., 2013). Research on discourse within group work has pointed to the learning opportunities that arise as students explain their reasoning, justify their ideas, and participate in extended mathematical discussions (Chizhik, 2001; Schoenfeld, 2002; Webb, 1989). As suggested by Walshaw & Anthony (2010), talking about mathematical discussion, explanation, and defense of ideas become defining features of a quality mathematical experience" (p. 516).

A key question is under what classroom conditions discourse leads to mathematical learning outcomes of interest. A comprehensive overview of this topic is taken up in Esmonde's (2009a)

review of research on cooperative mathematics learning. In broad strokes, one common empirical theme is that mathematical reasoning and practices are supported when students' group discourse reflect practices of *intersubjectivity*. That is, when discourse involves students' "comparing of ideas and coming to know the practices of other group members" (Esmonde, 2009a, p. 1017), it can help them build conceptual understanding of mathematical ideas. Mathematical learning is also enhanced in group work when students collaborate on *groupworthy tasks*, which involve solving ill-defined, non-routine problems for which multiple perspectives and competencies are required (Cohen, 1994; Cohen & Lotan, 2014). In addition, there is evidence that content learning is enhanced particularly for the students who are actively involved in talking and making verbal contributions in group work, and is reduced for students who are more passive (Mulryan, 1994; Webb, 1989, 1991, 2009).

This last finding—that learning in group work is connected to being an active contributor points to the consequential impact of issues of power, status, and equitable participation in classroom discourse. While classroom discourse may create powerful opportunities to learn for students who are successful contributors, students who are in more passive positions are not afforded the same opportunities to learn (Cohen, Lotan, Scarloss, & Arellano, 1999). A central consideration in discourse, then, is the relative positioning from which participants engage with one another in discourse. According to expectation states theory (Berger, Cohen, & Zelditch, 1972; Correll & Ridgeway, 2003), a sociological theory that portrays how group members establish expectations about one another's relative competence, participants in discursive activity are positioned in hierarchies based on various sources of status that arise in the classroom. Differential status can be influenced by high-level categories from the larger system of social stratification (e.g., race, gender, class, and language status), as well as by more local sources

such as previous academic achievement, perceived ability, and social popularity (Cohen & Lotan, 1997, 2014). Group members draw from these sources to sort participants as more competent or less competent in group activities, regardless of whether or not their designations align with the activity. In this way, students' differential status within and outside a classroom can have a profound influence on the ways students position themselves and are positioned by others during discursive activities. Ultimately, status-based positioning can place constraints on opportunities for participants positioned in lower hierarchical tiers in social and cultural contexts (Harré & Davies, 1990; Harré & Moghaddam, 2003; 2008). Developing an understanding of the benefits of discourse for learning must be intertwined with the study of how discursive structures may either support or hinder equitable learning.

Mathematics classroom discourse and identity

With the emergence of sociocultural approaches in mathematics education research, mathematical learning has come to be understood as a social activity rather than one that happens solely in the mind of the individual (Bransford, Brown, & Cocking, 2000; Lerman, 2000). I take up a more thorough discussion of this perspective in my discussion of theoretical frameworks further on in this chapter, but for now it is useful to summarize that in sociocultural theory, learning is viewed as being situated within the practices, language, and representations of a community (e.g., Brown, Collins, & Duguid, 1989; Collins, Brown, & Newman, 1987; Lave and Wenger, 1991; Nolen, Ward, & Horn, 2011; Saxe, 1999, Wenger, 1998). From this perspective, classroom discourse is not merely a vehicle for students to learn mathematics content; rather, discourse and learning are integrative. From a situated perspective, learning occurs as one constructs an identity of participation in relation to the norms, language, and activities of the mathematics classroom ecology (Fleer, 2011; Hickey, 2011; McInerney, et al., 2011; Nasir, 2000; Nasir & Hand, 2008; Nolen, Ward, & Horn, 2011), moving from peripheral to more central forms of participation. The focus of research moves beyond whether or how discourse may be helpful for students' mathematics learning, and toward the identities of participation that are available to students through the discursive opportunities and affordances in the classroom ecology (Boaler, 2006; Boaler & Greeno, 2000; Boaler & Staples, 2008; Gresalfi, 2009; Gresalfi, Martin, Hand, & Greeno, 2009).

Research conducted from this perspective of learning has shown how mathematics classroom environments can favor students whose experiences and background are more closely aligned with, and therefore privileged to the discursive norms and practices of the environment (Lubienski, 2007; Nasir, Rosebery, Warren, & Lee, 2006). Often this privilege accompanies white, middle-class students but not students of color, low-income students, or those for whom English is a second language.

For students of color, girls, working-class students, and others who are not always positioned as mathematically competent students, considerable work must be done to merge their positive academic identifications with their identifications of other social communities and to facilitate their fluent participation in these multiple and sometimes very different discourses (Esmonde, 2009a, p. 1019).

This "considerable work" has taken many forms for students who are not identified with dominant groups in discourse. Attempts to design more equitable spaces, structures, and opportunities for classroom discourse have produced a range of results. In broad terms, the introduction of group work as a strategy by itself has not been shown as a consistently successful approach to broadening participation, particularly for students of color, female students, and working class students (e.g., Chizhik, 2001; Kurth, Anderson, & Palinscar, 2002; Langer-Osuna, 2011). Despite the potential that group work may hold for students to develop productive

identities toward mathematics, the specifics of enactment can create or exacerbate equity issues if they are not tended to explicitly.

One approach to mitigating inequitable positioning is through considerations of group composition, for which research has generated a somewhat mixed set of findings. For example, balancing gender within collaborative groups has been shown to improve achievement for both males and females in group work in K-12 mathematics (e.g., Cen, Ruta, Powell, & Ng, 2014; Webb, 1984) as well as in post-secondary mathematics (Laursen, Hassi, Kogan, & Weston, 2014), but also that female students must often overcome marginalization from discourse, particularly in environments where competence is closely associated with masculinity (Langer-Osuna, 2011; Mendick, 2005). Studies related to whether discourse is better supported when friends work together has also been somewhat inconclusive, and seems to depend on the context, task, and nature of the friendship (e.g., Walker, 2006).

A range of other group paradigms are problematized in Esmonde's (2009a) review. Should, for example, students in collaborative environments be grouped by prior achievement levels? Research on this question has produced contradictory findings, but based on the fact that in many settings, students of color and poor students are disproportionately categorized as low achieving (Lee, 2002), the issue "... is as much a political as it is empirical and will so depend on one's values for equity in education" (Esmonde, 2009a, p. 1021). Conversely, it appears that beyond mere grouping configurations, intentional supports and structures that specifically attend to students' diverse identities can allow for more equitable participation for marginalized groups. These include approaches that integrate students' cultural practices (Gutiérrez & Rogoff, 2003), community identities (Nasir, et al., 2006), and language (Moschkovich, 2002) into mathematics-related discourse, and have been shown to allow for broader participation.

Another perspective for studying discursive interactions looks at how the status differentials described in expectation states theory might be mitigated within groups, regardless of how groups are configured. From this perspective, the phenomenon of interest is how interactions influence students' positional identities in discourse (Boaler, 2008; Boaler, et al., 2006; Boaler & Staples, 2008). In a foundational strand of research on the development of positional identities in group work, Complex Instruction has been studied as a particular model for structuring group work around groupworthy tasks, which are ill-structured problems specifically designed to distribute opportunities for meaningful contributions across status levels. In Complex Instruction, tasks are enacted such that competence is explicitly assigned to lower-status students by the teacher and ultimately by higher-status peers as well, such that the group as a whole arrives at fuller forms of mathematical knowledge (Cohen & Lotan, 2014; Selling, 2016; Webb, Nemer, & Zuniga, 2002). In addition, specific roles are assigned to students to distribute forms of authority across status levels. Although there are specific challenges associated with implementation of role assignments (e.g., students not fulfilling their assigned roles or doing so without attention to collaborative norms and behaviors), such roles have been shown to position lower-status students as more contributory members of the group (Bianchini, 1999; Selling, 2016). Overall, the research related to Complex Instruction has established that as more positive positional identities become available to students, status differences are mitigated, equalizing opportunities to contribute and learn.

As research moves forward in relation to how students enact particular roles and dispositions within group work, a goal is to document not only which particular practices support equitable discourse, but also how and why students take up the opportunities to participate in mathematical activity as they are afforded within particular classroom communities. A case study analysis by
Gresalfi (2009) focused squarely on this issue by examining the differences in the emergent dispositions of four students in two eighth-grade algebra classrooms. The case study showed how students' dispositions toward the discursive mathematical activity were neither fixed at the individual student level, nor were they entirely determined by the classroom environment. Rather, they were influenced by complex interrelationships among each student's individual forms of participation, the discourse among students within small group work, and the intervention of the teacher. Although not deterministically, factors related to the classroom activity system appeared to make the engendering of active mathematical dispositions more or less likely, depending on the opportunities available in the classroom. For example, the two classrooms in the study differed in the relative strength of affordances to engage with mathematics and with other students. Where in both classrooms group work was enacted with regularity, one of the classrooms was characterized by more explicit, "forceful" norms and expectations about students' agency, authority, and obligations toward developing mutual understanding among participants in group work than the other. In the classroom with stronger opportunities, both high- and low-performing students tended to form more active, collaborative dispositions toward learning mathematics, and also demonstrated a shift toward such dispositions over the course of the school year. This study sheds light on how individual students take up opportunities and affordances in different environments, and highlights the influence of the strength of opportunities as integral to students' development of dispositions in mathematics classroom activity. A question is suggested for further exploration in the study regarding the individual differences of disposition that may emerge (or persist) among students within the same classroom system.

Thus, although a classroom system that affords more forceful opportunities to make connections between ideas increases the likelihood that more students will take up that

opportunity, the mere existence of more forceful opportunities does not guarantee that they will be taken up. This appears to be due in part to the dispositional stance of the individual and in part to the complexity and interdependence of aspects of classroom systems (Gresalfi, 2009, p. 362).

These "dispositional stances" that individual students bring to bear on classroom opportunities represent an area of inquiry that is open for further exploration, and focal point for the present study.

Also in relation to how and why students take up opportunities in mathematics classroom discourse, Esmonde (2009b) conducted a yearlong study in which two different group activity structures (group presentations and a group quiz) were analyzed for the types of work practices and positions students adopted in each. The analysis showed that more equitable participation occurred through the group presentations, but that this structure was enhanced if a student was positioned as a facilitator for the group. In the group quiz structure, discourse tended to be dominated by students positioned as experts. At a broader level, the study demonstrated the level of improvisation that occurs among students in structured group activities, where students constituted a range of different work practices within the activity (e.g., collaboration, individual work, helping). In turn, each of these work practices entailed different sets of positions and goals across groups, as explained in relation to the practice of helping.

The helping interactions appeared to be oriented toward finding the single correct answer, and quickly. In some classroom communities, mathematical 'smartness' is displayed through 'finding the answer' quickly and not necessarily through other mathematical practices such as coming up with conjectures, justifying one's thinking, or creating a representation (Boaler, 2008). Although the teacher in this classroom explicitly tried to move students away from these conceptions (and was successful to some degree), these beliefs about mathematics seemed to underlie the interactions in which some students were positioned as expert and some as novice (Esmonde, 2009b, p. 273)

In this account of positioning in group work, students' beliefs, previous experiences, and broader identities are shown to influence enactments of particular roles. Specifically, the ways students constructed the work practice of helping seemed to be influenced by their prior experiences and identities related to what it means to be competent in a mathematics classroom. Esmonde (2009b) does not explore these interconnections in depth as part of this analysis, though the findings motivate further research into how aspects of students' identities may influence the ways that roles and work practices are shaped within group work.

Others have analyzed how micro-level enactments of discourse shape the identities students are able to access in mathematics classrooms (Bishop, 2011; Esmonde & Langer-Osuna, 2013; Wood, 2013). Taking an approach focused on moment-to-moment discourse among two students, Bishop (2011) showed how discourse between two 7th-grade mathematics students shaped the positional roles two students constructed for themselves and each other during partner activities. The two students, Bonnie and Teri (who also considered themselves best friends outside of class), were observed over the course of several weeks during collaborative partner work in a technology-rich unit on rate and proportionality. Their interaction was shown to be characterized by five types of positioning acts: using an authoritarian voice, making statements of inferiority/superiority, engaging in face-saving moves, building solidarity and encouraging one another, and controlling problem-solving strategies. Over the course of the unit, consistent, microlevel patterns emerged within and between these positioning acts in which Teri controlled the discourse and Bonnie waited for "more knowledgeable others to act and make decisions... frequently surrendering her freedom to direct mathematical action and having her ideas ignored" (p. 65). Through these patterns that collected over frequent and sustained micro-level interactions, both students came to position Teri as the "smart one" and Bonnie as the "dumb one" in their mathematics collaboration. One such interaction is poignantly illustrated in which Bonnie and Teri arrive at separate strategies for finding values in a proportional relationship.

Although Bonnie proposes a more mathematically sophisticated strategy, her idea is not recognized by Teri (until a later time when Teri comes to it independently and claims it as her own). Eventually Bonnie abandons her strategy for Teri's original, less sophisticated approach.

These types of discursive details are discussed as accruing in an "accumulation of disadvantage" (Valian, 1998; Zuckerman, 1998) played out in the minutia of whose ideas are taken up, who takes turns, and who responds to whom (or not). In discussing limitations of the analysis, Bishop (2011) alludes to the need for understanding the multiple and broad contexts in which these students operate. Such understanding can perhaps explain how these instances start to accumulate in the first place. Though these considerations lie beyond the scope of this micro-level study, they suggest a launch point of further research on how mediating factors influenced the girls' consistent enactment of these positions. For example, can explanations for these patterns be found in their broader classroom context, in the girls' history of friendship outside of the classroom, in their school or community, in their family lives, gendered and racial expectations, life narratives, and so on? Exploration of these contextual factors could connect the discursive micro-level "accumulations" to a holistic understanding of identity development at the meso- and macro-levels as well.

Discourse and Participation from the Learner's Perspective

Drawing an empirical connection between classroom-level discourse and the broader contextual factors mentioned above presents a unique analytical challenge. The approach must be suited to identifying the interplay of identities across micro-, meso-, and macro-levels of analysis. In this respect, analysis that privileges perspectives of the learners themselves may provide a window into these connections in a way that may be far more challenging. In this

section, I draw from research that explicitly attends to students' perspectives to explain their participation in classroom-level discourse in connection to their broader identities.

Learners' perspectives on group work and categorical identities

This approach is exemplified in a study by Esmonde, Brodie, Dookie, & Takeuchi (2009), in which students described how their identities related to social categories (e.g., race, gender, class) influenced their group interactions in an urban mathematics classroom. In this case study, Esmonde et al. interviewed 14 high school students about their interactions during group work, focusing on their beliefs about the efficacy of their collaboration, i.e., what "went well," and what "didn't go well."

Students' reflections centered around 4 factors influencing the effectiveness of groups: interactional style, mathematical understanding, friendship/relationships, and social identities. Of these, interactional style was the most commonly referenced factor. This factor represented a complex array of intrapersonal and interpersonal aspects of discourse, including perceptions about personality, group dynamics, and the ways roles and responsibilities were taken up. Interactional style was typically described as being influenced by other variables, such as the type of task or level of mathematical thinking the task required. Students' relative level of mathematical understanding was also often discussed as an important factor in group interaction. For some students, having a heterogeneous mix of levels within a group was considered more effective; for others—generally those who identified themselves as high-achieving homogeneous groups with similarly high achieving students were thought to be more effective. In both cases, students still consistently reported challenges of working with students whose mathematical understanding was at a different level from their own. With respect to friendships,

students described both a positive and negative impact on group effectiveness, depending on whether friends were able to overcome distractions in their collaborative work.

The central focus of this study involved the ways students described social categories as influencing their discursive interactions in the classroom. Esmonde, et al. (2009) use the term *social categories* to refer to categorical identities that are often assigned to individuals with respect to race, culture, gender, language, and social class. It was found that the students seldom referred directly and explicitly to social categories as a factor in their group work. Students who did so were predominantly from non-dominant categories, such that students of color tended to describe race as a factor and female students tended to describe gender as a factor. References to racial and gender categories were often made in generalized terms, as when students described valuing diversity within groups. These references were interpreted by the authors as a way for students to refer to race and gender in a less controversial way. Generalized statements about valuing diversity were also at times contradicted by more specific indications of a preference for racial homogeneity in groups.

In light of the limited number of explicit references to social categories, the authors also analyzed students' more implicit messages about the influence of social categories on group work. From this analysis, several patterns emerged. Male students tended to describe themselves in leadership roles and female students tended to describe themselves in more passive roles, particularly when groups consisted of all white students or all students of color. Similarly, white students tended to describe themselves as leaders and African American and Latinx students as passive. This latter tendency was connected to another pattern, where students of color often described a preference for interacting with other students of color. This same tendency did not hold for white students, which the authors attributed to their operating from a position of higher

categorical privilege, and therefore they "did not have to struggle to create opportunities to learn for themselves" (p. 39).

In the authors' summative discussion of their findings, they highlight how the four factors described above appear to work in combination with each other in complex ways that influence how effective students find group work in this classroom. From within the mix of these complexities, students often see their individual goals as acting in competition with the needs of the group, and they struggle with the resulting tensions that arise. Although the classroom teacher was committed to the principles of Complex Instruction and paid attention to maintaining equitable discourse within and among groups, these tensions—and their persistent influence in maintaining status differences related to social categories—led the authors to question the viability of equitable discourse within heterogeneous group work in mathematics. In this way, the study surfaces concerns about equity in group work that has been raised by others as well. In my view, the authors' concerns point to the need for further research that seeks counternarratives to contrast the persistent narratives of inequitable discourse, and then to study such counternarratives with an eye for the conditions and factors that led to more equitable positioning in discourse marked by differences in categorical status.

Investment as a window into learners' perspectives on participation

Another strand of research that privileges the learner's perspective has emerged from the field of second-language acquisition. This research focuses on the construct of *investment*, which Pierce (1995) defines from a sociocultural perspective as the willingness to participate in a social or cultural activity as it is related to a potential return of resources—be they material, symbolic, social, or cultural—in relation to one's continually developing identity (see also Charbonneau-

Gowdy, 2006; McKay & Wong, 1996; Parks, 2000; Pierce, 1995; Pittaway, 2004; Thesen, 1997; Zuengler & Miller, 2006). In mathematics education research, the idea of investment is commonly raised as a salient issue in the literature (e.g., Gal & Ginsburg, 1994; Ke, 2008; Nasir & Shah, 2011; Nolen, Ward, & Horn, 2011), but it has not been explicitly defined or empirically explored in the field. In second-language acquisition theory, Pierce (1995) argues that investment encompasses the relationship of the learner "to the changing social world. It conceives of the… learner as having a complex social identity and multiple desires" (pp. 17-18).

Research focused on investment has broadly demonstrated that participation in secondlanguage learning is connected to a learner's understanding of its potential for positive identity development related to other contexts and communities. For example, the ways immigrant female English-learners took up—or resisted taking up—opportunities to learn and speak English were related to dynamic and complex interactions between their social identities in the world and their motivation to learn English (Pierce, 1995). For one of the women in this study, for example, her identity as the primary caregiver in the family shaped her participation in English-language discourse, as it empowered her in her responsibilities for the family's dealings in the public world, despite her professed discomfort and lack of confidence with speaking English in the face of societal barriers. The author argued that the woman's investment in her identity as primary caregiver influenced her taking up opportunities to interact in English. In this sense, her effort was expended against her own personal affective barriers and the societal barriers she faced, and it yielded a return of resources—namely, the ability to interact publically on behalf of her family.

In a study of three students in an ESL course at a French-Canadian university, Parks (2000) found that English-language learners attached different values to a classroom activity in which

they were asked to produce a travel video in English. The author argued that students' investment in particular *value systems* related to their social identities in the world influenced their participation in the video production project. For example, although one of the students in the study reported a positive orientation to learning English, she did not see the video project as worthwhile. She attributed this to the more "traditional, conversational" approach to language learning that was taken up in previous classrooms, and to her having achieved more success through those experiences than through formally designed classroom activities. Another student *did* see the project as useful to learning English, but she resisted participating in the collaborative aspects of the project, in part because of her previous schooling experiences that promoted a highly individualistic approach to literacy learning. A third student, who also saw the project as useful, was highly invested in the video format "enabled her to control the image of herself she wished others to see," whereas "the relative spontaneity of an oral presentation could not" (Parks, 2000, p. 82).

Collectively, this research demonstrates how investment emerges as a dynamic construct that

...conceives of the learner as having a complex history and multiple desires. An investment in the target language is also an investment in a learner's own social identity, which changes across time and space. (Pierce, 1995, p. 411)

Furthermore, Parks (2000) showed that responses of appropriation or resistance to the "mediational means of learning in a classroom" (p. 81) are varied and relatively fine-grained, even within the experience of an individual learner. That is, students do not invest in or resist classroom activity wholesale. Rather, there are particular aspects of classroom activity that align with particular aspects of a learner's identities, and also that misalign.

Research on investment suggests a view of mathematical learning as occurring at the intersection between classroom activity and students' identities outside of the classroom. Recognizing that mathematics learning does not occur in isolated contexts, research on investment suggests an empirical approach to studying how multimembership may influence students participation in mathematics workshop discourse.

Discourse in the Context of ESP Workshops

The Emerging Scholars Program (ESP) originated in 1977 at the University of California (UC) at Berkeley, initially as the calculus workshop component of a broader program of student support, then known as the Professional Development Program (PDP). Although some of the structures and design features from the original PDP calculus workshops have changed as the program has evolved over the years, the foundational principles remained intact through its evolution toward the current ESP model (Hsu, Murphy, & Treisman, 2008). In its current implementations at a substantial number of post-secondary institutions across the United States (Asera, 2001), Emerging Scholar programs offer elective workshops that coincide with introductory mathematics and science "gateway" courses required for STEM-field majors. Workshop offerings typically accompany precalculus, calculus, chemistry, and physics courses. The workshops are designed to provide an academically rich setting in which students can work collaboratively to learn major concepts in the accompanying course. A defining aspect of ESP—which separates it from more traditional approaches to student support and access—is that the program emphasizes disciplinary rigor rather than remediation or more generalized study skills.

The premise of the workshop program was borne out of early qualitative research in the Mathematics Department at UC-Berkeley, conducted to better understand issues of minority

students' access to success in mathematics courses, and to apply resources to address them. Ethnographic studies of undergraduate calculus students conducted at Berkeley revealed that Black students tended to study in isolation, whereas Chinese students tended to study in supportive groups that helped them make sense of complex mathematics, as well as navigate their academic lives more broadly (Fullilove & Treisman, 1990; Treisman, 1985; Treisman & Asera, 1990). The social and disciplinary supports these social groups provided were thought to coincide with Chinese students' higher likelihood of achieving high grades in calculus and Black students' higher likelihood of failing the course. With an understanding of the high consequences of passing or failing introductory calculus on subsequent academic success, the Mathematics Department implemented its first workshops with the intention of establishing diverse, supportive groups for students to work collaboratively on challenging calculus problems and build a sense of community. A specific intention was to include African American and Latinx students in the program, though not exclusively, based on an assumption of the value of diversity toward the goals of the program. Recruitment was therefore widespread and did not explicitly target or omit any groups of students. The initial implementation of the program was met with initial indicators of success (to be discussed in more detail further on), which ultimately led to ESP being disseminated to universities, colleges, and community colleges across the country under the same guiding principles as the seminal program at UC-Berkeley.

Although implementations of ESP vary based on local institutional contexts and policies, research on the dissemination of the model shows consistency of basic structural design features from site to site (Alexander, Burda, & Millar, 1997; Moreno, Muller, Asera, Wyatt, & Epperson; Treisman & Asera, 1990). Workshops are typically offered as elective courses with a satisfactory/unsatisfactory grade assigned, and are generally smaller than the typical lectures and

"recitation" sections. Class sizes are usually relatively small, ranging from 12 to 20 students. Workshops also meet for comparatively long blocks of time of between 1.5 and 2 hours, as a means for students to persevere with their peers in solving difficult problems. These problems are specifically constructed to bring concepts together, address students' common difficulties without remediation, and provide tasks that are challenging enough to generate collaboration (Asera, 2001). During the workshop itself, students work independently or collaboratively on the problems in a relatively unstructured environment in which the instructor helps mathematical conversations to emerge and progress, but does not answer questions directly, and does not demonstrate solutions to students. The workshop also provides space where students connect socially during "down time," discuss issues related to the calculus course, or converse about their academic lives more broadly.

Several studies have been conducted on outcomes of ESP workshops related to course grades, course completion, and degree completion. These studies are succinctly summarized by Hsu, Murphy, & Treisman (2008) in their report on what has been learned about ESP in its 30-year history.

...participants tend to achieve higher grades in calculus than underrepresented students who do not participate in the program—and often ESP participants receive higher grades than their (nonparticipant) white and Asian classmates (Alexander, Burda, & Millar, 1997; Bonsangue, 1994; Fullilove & Treisman, 1990; Moreno, Muller, Asera, Wyatt, & Epperson, 1999; Murphy, Stafford, & McCreary, 1998). ESP participants are more likely to complete the calculus sequence than nonparticipants (Alexander, Burda, & Millar, 1997; Murphy, Stafford, & McCreary, 1998). Furthermore, underrepresented minority students who participated in an ESP are more likely to persist in a calculus-based major (Bonsangue, 1994; Murphy, Stafford, & McCreary, 1998) (p. 5).

The authors issue some caution about interpreting these studies because of the self-selection bias involved in studying an opt-in program. Still, comparisons between ESP and control students

across these studies showed the groups to be comparable based on admissions criteria, leading to reasonable interpretations about the impact of ESP participation.

Notably missing from these studies are analyses that attempt to explain specific factors associated with these outcomes. Little is currently known, therefore, about what aspects of ESP workshops may contribute to measures of student success. One exception is found in a study conducted by Herzig and Kung (2003), from which it was suggested that successful outcomes were linked to some combination of the extended time, focus on group work, community building, and the self-selection of the students who enroll. As these factors constitute the majority of the ESP blueprint, the analysis supports a claim about the overall design efficacy, but further research is needed to explore how these factors may interact in support of students' success, particularly for students of color.

In a historical account of the program, Asera (2001) describes some of the key assumptions and rationale for the design of the program. Particularly salient to the present study are the rationale related to "collaboration and community" features of the program. As has been alluded to previously, the ESP program's alternative model of post-secondary mathematics socialization emphasizes collaborative work and discourse in the workshops. Primarily from interviews with Uri Treisman, acknowledged as the founder of PDP and ESP, Asera (2001) describes the rationale for collaborative work in the design.

Over the life of the program, it has become evident that this group work does more than just help students learn the mathematics: it helps them learn what it is to be part of an academic community. The intent of student interaction in the workshops, however, was not originally to create social support. Nor was it pedagogical, as is true of many collaborative learning theories, which have those students who understand an idea teach it to those who don't. Rather, the intent of the group work was academic: it was to foster conversations in which the students had to articulate their own mathematical ideas and listen to the mathematical ideas of others (p. 15).

Thus, the rationale of collaborative work is two-fold. First, it is intended to support mathematical learning through conversation. Second, it is intended to foster a sense of community. Associated with these rationale are several assumptions about the particular benefits of group interaction. For example, the author describes an assumption that students benefit from encountering other students having to apply effort to solve difficult problems, such that students' persistence grows through recognition of a "shared struggle." It is also suggested that the public, shared nature of the work may allay the effects of *stereotype threat* (Steele and Aronsen, 1995), defined as circumstances in which learners are subject to the risk of conforming to deficit-based stereotypes about their membership in a social group. The notion of a publicly shared struggle is thought to mitigate stereotype threat because there is a common recognition that every student in the workshop, regardless of sociocategorical background, will have to struggle to succeed. Similarly, through collaboration with peers, students may come to an understanding of the amount of work it takes to succeed in calculus because they are able to triangulate their level of effort with others, reducing the risk of disillusionment from underestimating workload and thus underperforming. Finally, a collaborative environment is presumed to foster social connections among students that allow for familiar, comfortable relationships to develop. This familiarity, in turn, creates a safe space for exploring mathematical ideas and making mistakes along the way.

In light of some of the broader research from mathematics education on discourse and group work that has been discussed earlier in this chapter, these assumptions might be problematized in the context of actual ESP workshops. For example, while a rational, design-based approach might support the notion that public mathematics discourse would allay stereotype threat, Esmonde, et al.'s (2009) study would suggest that, at least in some interactions, this may not necessarily be the case. Rather, groups comprised of students from different racial categories can

maintain or even exacerbate status differences based on hierarchies of privilege. It is possible that this rationale for the design of ESP workshops may in fact be more nuanced, variable, or situational when examined closely in workshop implementations. Investigating the validity of these design assumptions is an important area for ongoing research on the ESP model, as well as other designs built upon similar principles.

One extensive case study of an ESP workshop represented the first significant strides toward understanding qualitative aspects of students' participation in the workshop (Oppland, 2010; Oppland-Cordell & Martin, 2014). This case study investigated the shifts in participation of several Latinx students over the course of a semester-long calculus workshop, and in doing so tested—and in some ways validated—some of the ESP design assumptions discussed above. The case study describes how several students moved from working in predominantly Latinx peer groups to working in increasingly diverse groups of students over the course of the semester. Beyond changes in group configurations alone, participants also described changes in their identities related to mathematics, in their identities related to gender, and in their identities as Latinx students, particularly in relation to students from other racial and ethnic categories:

...participants realized they possessed similar mathematical strengths to peers who they had once viewed as mathematically superior (e.g., Asian students). This happened because they observed peers from various cultural groups encountering mathematical challenges, and they observed students from various cultural groups, including Latin@s, exhibiting strong mathematical abilities (Oppland-Cordell & Martin, 2014, p. 42)

This finding is coincident with the design rationale for collaboration and discourse in ESP described by Asera (2001), in which students benefit from experiencing a shared struggle and in which stereotype threat is reduced because of the public, shared nature of collaborative work. Furthermore, the sociocultural and sociopolitical perspective from which this case study is analyzed highlights a process occurring in the workshop that extends beyond the design

assumptions and rationale: that in this case the workshop ecology supported students' construction of positive identities at the intersection of mathematics, gender, and Latinx culture. These findings invite further research into how identities are constructed by students from other groups and social categories across a range of ESP contexts, and how ESP design principles related to discourse and group work might be further problematized and challenged toward a deeper understanding of how individual students identify with workshop discourse.

Key Theoretical Frameworks

The present study focuses on students' identities as they are constructed in relation to the discourse within a calculus workshop community, but which interact with students' histories, experiences, and identities as constructed in their lives more broadly as well. From among the extensive and diverse perspectives on identity found in education research literature, I consider three key theoretical perspectives related to identity that are especially influential in guiding my own views of identity, as well providing useful analytical tools for a study focused on students' identity and participation in relation to mathematics classroom discourse. These perspectives include: 1) identity as related to membership and participation in a community of practice, 2) identification with community practices as representing the modes by which students fulfill obligations of the community, and 3) identity formulate the basis of an initial theoretical model I will propose to structure my overall analysis of students' identification with workshop discourse.

A Situated Perspective: Identity in Relation to Communities of Practice

From a situated perspective, learning is an inherently social activity whose meaning is integrated into the construct of *identity*. From its conceptual roots in cognitive psychology, sociology, anthropology, and critical theory, the identity has more recently emerged as an eminent theoretical construct in education research, where it is defined in a variety of ways, e.g., as being recognized as a certain kind of person in a particular context (Gee, 2001), as one's narratives about who one is (Sfard & Prusak, 2005), or as one's ongoing creation of self through social interaction (Bauman, 1996; Roth, 2004).

Although educational psychology has established a broad base of knowledge about learning as it occurs within the mind of the individual, a common criticism weighed against orientations from behavioral and cognitive psychology is that they do not adequately address the social, participatory nature of learning. Contributions to learning theory from the fields of social psychology, sociology, and anthropology present an alternative perspective to primarily individualistic, cognitive notions about learning and motivation in school contexts. Because of this repositioning of learning in terms of social interaction and participation in cultural activities (Lerman, 2000), sociocultural and situated theories have expanded learning theory to define learning as an inherently social and cultural phenomenon, rather than as an individual's cognitive processes that are influenced by social interaction.

Developed out of Vygotskian social constructivism of the early-20th century (Vygotsky, 1978), *sociocultural theory* generally holds that: (1) learning is an inherently social process, (2) learning involves a progression from novice to expert, (3) learning is a discursive activity, and (4) learning involves the negotiation of meaning (van Oers, 1996). As anthropologists began developing detailed ethnographic accounts of learning within cultural communities, a theoretical

framework of learning—related to sociocultural theory but generated from an anthropological instead of a psychological orientation—emerged that would come to be known as *situated learning* (Brown, Collins, & Duguid, 1989; Collins, Brown, & Newman, 1987; Lave and Wenger, 1991). This framework was constructed on the notion that apprenticeship within a cultural community is more than a particular context in which learning takes place; rather, it can serve as a model that shifts the way learning is conceived. While cognitively-based theories positioned learning as occurring predominantly within the learner, situated theory characterized knowing, communicating, and learning as interdependent social phenomena that occur within *communities of practice*, or communities engaged in a common enterprise (Lave & Wenger, 1991; Wenger, 1998). From this perspective, learning is conceptualized as a progression from *legitimate peripheral forms of participation* (LPPs) within the practice (Lave & Wenger, 1991; Wenger, 1998). These forms of participation generally, though not rigidly, follow a progression from novice/newcomer/beginner to expert/old-timer/master.

When considered in terms of participation in a community of practice, learning is recast in terms of its connection to the community. Viewed from a situated perspective, learning involves the construction of an *identity* that moves toward more central forms of participation—toward becoming a more expert, contributory agent in the culture and practices of the community. As such, learning is generated from within the shifting relationships that occur among the participants, artifacts, tools, and practices within the community (Fleer, 2011; Hickey, 2011; McInerney, et al., 2011; Nasir, 2000; Nasir & Hand, 2008; Nolen, Ward, & Horn, 2011). Rather than arising as a product of the cognitive or affective traits of an individual, identities "…arise

through the interaction of elements of the social system over time (including both people and objects)..." (Nolen, Ward, & Horn, 2011, p. 113).

When viewed from a situated perspective on learning, identity is cast as a central construct that in a sense defines the very nature of learning. That is, the essence of learning is found in its relationship to identity development as a social and cultural phenomenon—a holistic process of *becoming* in relation to a community (Wenger, 1998). For the purposes of this research, I consider identity construction at the classroom level to occur as a complex integration of "participatory experiences and reificative projections" and as the "constant work of negotiating the self" in relation to the classroom community of practice (p. 151).

Exploration of classroom-based identities requires unpacking the processes by which identities are constructed. Wenger (1998) theorizes that identities develop through three distinct "modes of belonging" in a community of practice. *Engagement* involves the direct experiences of participation in the community. Those experiences translate into direct responses of identification and participation, or conversely, resistance and non-participation. *Imagination* is the way participants see the activities fitting into their broader lives and the world, in both the present and future. For example, to what degree do students in a mathematics classroom see classroom activities as important to who they are in the world, what they wish to accomplish, and who they hope to become in the future? *Alignment* refers to the ways participants' formulate themselves and their activities within the boundaries of a larger cultural institution.

Anderson (2007) looks at each of these modes of belonging in terms of its influence on students' academic identity development specifically in relation to mathematics classrooms (see 2.1). The *engagement mode*, for example, is demonstrated when students who generate correct answers quickly flourish in an environment where quick answer-getting is emphasized and

valued. Such correspondences between the individual and the community tend to develop the individual's positive identities toward engagement. Students who do not experience success in this type of environment, conversely, are less likely to identify with mathematical activity, both in the classroom and in general.

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Mode of belonging	In a community of practice	In a mathematics classroom
Engagement	 sharing in the community's activities and attaining competence 	 identifying with the normative practices in the classroom attaining competence with classroom obligations
Imagination	• seeing participation in the community as instrumental in becoming one's "imagined self"	 seeing participation as a means to become a successful student, a college graduate, a STEM professional, an agent of social change, etc.
Alignment	• desiring to belong to a larger social/cultural entity or institution associated with the community of practice	 staying on-track with school/district course requirements adopting the practices of professional mathematicians

Table 2.1. Modes of Belonging in a "Generalized Community" and in a Mathematics Classroom

Where the classroom environment is organized around norms of meaning-making, discourse, and problem-solving, more students are likely to identify with mathematical activity because the environment provides a more expansive set of possibilities for making meaningful contributions. These more expansive forms of legitimate participation appeal more broadly to the *imagination mode* of belonging. As students define themselves and their futures, they see participation in mathematics as either connected or disconnected from their imagined selves. A broader formulation of "valid" mathematical activity in the classroom creates a broader set of possible connections to these imagined selves. Finally, the *alignment mode* is demonstrated in students' participation in course-taking activities in response to the requirements of a major field of study, which aligns students' identities to institutional requirements.

Anderson's (2007) analysis points to specific aspects of a classroom environment that can have an important influence on students' development of mathematical identities. Two such aspects in particular have received significant attention in the literature. The first, closely related to the engagement mode of belonging, is the way that *competence* is defined in the classroom. Scholars contend that the type of participation that is valued in a mathematics classroom community tends to broaden or limit the meaning of what it means to be competent in mathematics, which in turn influences students' opportunities for participation in and identification with classroom mathematical activity (Boaler & Greeno, 2000; Greeno & Gresalfi, 2008; Gresalfi, Martin, Hand, & Greeno, 2009). Gresalfi, et al. (2009), for example, show empirically how when competence is constructed with attention to students' own experiences, their collective sense of accountability, and their developing understanding of mathematical concepts, rather than as a singular, "official" way of doing school mathematics, opportunities to participate as contributors to classroom mathematical activity become more available and more readily taken up by students. The second aspect involves the productive forms of *agency* that are supported in the classroom context. As defined by Nasir and Hand (2008), the forms and levels of agency developed in a learning environment are constituted by the authority students have to make unique contributions, carry out integral roles, and attain access to the domain and its specific skills and concepts. A consistent theme in sociocultural research is that when students develop agency in relation to solving problems—actively exploring their own and their peers' mathematical understanding, contributing ideas, and evaluating the contributions of others-their identification with mathematics activity tends to develop in more positive, productive ways (Cobb, 2007; Boaler & Greeno, 2000; Gresalfi, 2009; Nasir & Hand, 2008; Phelan, Davidson, & Yu, 1998). Thus, much of the research conducted from a sociocultural perspective has served to

establish a connection between identification and the particular norms and practices that are established within a given classroom environment.

Identification

The norms and practices of a classroom or any community in the broader sense come to define what it means to be a legitimate participant in that community. From a situated perspective, members may participate in those practices in ways that either draw them inward toward the center of the community or else pull them outward toward the periphery. In both cases, there is an ongoing (re)negotiation of identity with respect to the community. At the same time, Holland, Lanchicotte, Skinner, & Cain (1998) describe an internal process of *identification*, in which the communal activities initially carried out under the direction of others are adopted by the individual as a way to internally organize an understanding of one's thoughts, feelings, and self. This notion of identification stems from a view of identity that emphasizes self-understandings.

People tell others who they are, but even more important, they tell themselves and then try to act as though they are who they say they are. These self-understandings, especially those with strong emotional resonance for the teller, are what we refer to as identities. (Holland, et al., 1998, p. 3).

This definition suggests an aspect of identity that may not be evident through observing one's participation in the community because the same forms of participation might be carried out with very different self-understandings, or with different internalized forms of identification. For example, where one student in a mathematics classroom might answer a question from the teacher because it is what she ought to do based on the expectations of the teacher, another student might answer the same question in a similar way because contributing mathematically is

part of how she is coming to see herself as a person with something to contribute within (and possibly beyond) the classroom.

Cobb, Gresalfi, & Hodge (2009) integrate in their interpretive scheme for analyzing students' identity development in relation to classroom mathematical activity. In this framing, *normative identity* is defined as the obligations established in the classroom of what it means to be a "doer of mathematics." *Personal identity* refers to students' identification with those obligations, using Holland, et al.'s formulation of the term. The construct of personal identity specifically differentiates among three ways of participating in communal activities. When one carries out activities as an obligation to oneself, a participant demonstrates a personal identity of *affiliation*. When the obligation is to others in the community, one merely demonstrates *compliance* with the community norms and expectations. *Resistance* occurs when one refuses to comply and students develop oppositional identities in relation to community activities.

Cobb, et al.'s (2009) scheme was developed from an analysis of two distinct classroom environments. In one of the classrooms studied, an algebra class, the normative classroom obligations involved the production of correct answers using prescribed mathematical procedures. In a second, experimental classroom, obligations involved identifying patterns in data and developing insights through collaborative exploration. In the experimental classroom, there was a prevalence of students' affiliating with the normative obligations in the classroom. In the algebra classroom, there was a tendency toward personal identities of mere cooperation and resistance to the normative obligations. The analysis of emerging personal identities in this study ultimately tied into students' *valuations* of the normative obligations in the classroom.

Attending to the grounds for students' evaluations is important because we want to understand not merely whether but why students have come to identify with their classroom obligations, are merely cooperating with the teacher, or are developing oppositional identities (p. 47).

This question of *why* particular personal identities develop in classroom environments lies at the crux of the present study. An argument made by Cobb, et al., is that a key aspect of identification with a classroom community involves considering to whom students are obligated in their fulfillment of classroom obligations. The transition among students of turning obligations-to-others into obligations-to-themselves appears to be closely related to the distribution of authority among the students in the class, the valuation of conceptual understanding, and the broadened definition of competence.

In this study, I adapt the scheme as a way to extend understanding of why individual students take up particular personal identities, and how these personal identities vary situationally within a single classroom environment (rather than comparatively across classroom environments, as was the focus of the study by Cobb, et al.). Doing so requires analysis of the underlying factors that influence why students may or may not affiliate with various norms and practices, including the positions and roles students take up in discourse, as well as the influence of multimembership and identity-related factors acting across micro-, macro-, and meso-levels.

Multimembership and a Multi-level Framework for Identity Analysis

Multimembership

A particularly powerful aspect of studying learning in terms of identity development is its allowance for consideration of the individual's whole and emerging self. This approach broadens the focus on identity to include all of an individual's communities of practice and the emerging forms of participation related to each. As described by Wenger (1998), individuals do not organize their lives in linear or compartmentalized ways, but rather live them out through

membership across communities of participation, past and present, interwoven in a *nexus of multimembership*.

Our various forms of participation delineate pieces of a puzzle we put together rather than sharp boundaries between disconnected parts of ourselves. An identity is thus more than just a single trajectory; instead, it should be viewed as a nexus of multimembership [in which] identity is not a unity but neither is it simply fragmented (p. 159).

Wenger (1998) depicted the interaction of these forms of participation through his illustrative case study of a group of insurance claims processors. While their jobs characterize one aspect of their identities, claims processors also have families, other jobs, academic pursuits, hobbies, and memberships in churches, clubs, and organizations, as well as histories of affiliation and participation in these types of communities. Identities related to each of these forms of membership develop concurrently, and may interact with their identities and participation related to claims processing. Negotiating and reconciling all of these identities involves negotiating these different forms of membership and the accountability associated with each. These ideas were elaborated by Dreier (1999), who suggested that:

...persons live their lives by participating in complex structures of social practice and by conducting trajectories in and across diverse social contexts... A manysided person is not just having different streaks, sides, or patches, but is a reflection of living a many-sided life in which we pursue diverse concerns by participating in different ways in diverse contexts (pp. 29-30).

From this framing it can readily be inferred that the trajectories of multi-membership—that is, the crossing pathways of participation one takes through all of one's social communities both inside and outside of school—influence how one participates in any one of these given contexts (Dreier, 1999; Horn, 2008; Jurow, 2005; Nolen, Ward, & Horn, 2011; Pierce, 1995). These influences have been studied in mathematics education research, as for example in the ways students' identities developed in one mathematics classroom community are implicated in their ongoing identity development as they progress from grade level to grade level. Horn (2008) traced how high school students' personal orientations to mathematics in one classroom culture influenced their modes of engagement in classrooms during subsequent years. When students experienced a broad definition of mathematical competence in one classroom culture and then experienced a narrowed definition in a subsequent setting, the interactions between these experiences tended to form unstable identities with regard to mathematical competence. Such instability can erode previously positive perceptions about mathematical competence, ultimately reducing motivation to participate in school mathematics in general.

Similarly, Gresalfi (2009) studied how four students engaged in two different classrooms environments over the course of a school year—one classroom establishing accountability primarily to the teacher, the other establishing accountability primarily among students. The author noted how both the current classroom environment and students' *previously developed* dispositions toward mathematics shaped how they engaged in the classroom activities over the course of the year. A common implication of both Horn's (2008) and Gresalfi's (2009) analyses is that the influence of classroom environment on students' participation is mediated by what students bring to the classroom from the identities constructed in previous classroom communities.

Students' participation in mathematical activity may also be influenced by an array of identities students develop in relation to communities *outside* of mathematics classrooms. In a study of students' engagement in a classroom architectural design project involving mathematical problem-solving, Jurow (2005) analyzed how students' responses to the various concerns in the project were connected to how they saw themselves in relation to each of those concerns. For example, when students were explaining the mathematics of their designs, they

aligned their activity with a generalized identity of being a "mathematical thinker in the world." When they explained architectural aspects of their design, their activity aligned with identities as "real architects," for which they drew on their beliefs and experiences developed outside of the classroom about what it means to be an architect. When they rendered their designs graphically, they operated from identities related to being "artistic." When they asked questions about the requirements of the project, they operated from an identity of "math student," which was constructed both inside and outside of the classroom environment over a long history of participation in school mathematics.

Each of these concerns invites a possible avenue of participation in each aspect of the activity. What is not explored in Jurow's analysis are the specific identity connections behind students' taking up these concerns, but it is worth considering that each identity implicated by the project interacts with various trajectories in each student's nexus of multimembership in particular ways (Wenger, 1998). Jurow (2005) suggests that further study is needed to investigate how participation in other settings in a student's life interact with each of the figured worlds invoked in the classroom project, and how these interactions influence students' motivation to participate.

As alluded to earlier, the negotiation of multiple identities across various social communities requires a consideration of the *boundaries* that exist between memberships in these communities. Phelan, Davidson, & Cao (1991) studied how students' academic engagement was influenced by interactions across boundaries between students' school, peer, and family memberships. From an analysis of 54 students across four diversely populated urban and suburban high schools, Phelan, et al., identified four patterns of engagement demonstrated by students moving across the boundaries between their social worlds. In one pattern, students experience congruency among

the majority of their worlds, and relationships with families and peers support academic engagement. In a second pattern, students experience their family, peer, and school worlds as different and disconnected from each other, thereby requiring adjustment and reorientation as they transition between contexts. In a third pattern, students find these transitions hazardous, often only possible under particular conditions. In this pattern, for example, students may only engage academically in a class where the established classroom culture is congruent with peer or family worlds. In a fourth pattern, "boundaries are viewed as insurmountable, and students, actively or passively, resist attempts to embrace other worlds. Some [of these] students say that school is irrelevant to their lives" (p. 240). Although the construct of identity is not explicitly invoked, Phelan et al.'s classification provides an analytical tool for connecting students' academic identities with other aspects of identity that are constructed outside of the classroom. Studying the interactions across these "identity boundary lines" may therefore provide a lens to study how and why students choose to invest in classroom mathematics activity in particular.

Identities across multiple levels

As part of a broader framing of identity in mathematics, Martin (2000, 2009, 2012) conceptualized the development of mathematics identities as occurring across intrapersonal, school, community, and sociohistorical contexts. Identities are shaped by the forces acting at each of these levels and emerge in lived experiences across these levels. Building on a conceptualization of identity as occurring in the collection of stories and narratives one tells about who one is (Sfard & Prusak, 2005), Martin used detailed narrative accounts to show how the racial and mathematics identities of African American children and parents were socially co-constructed by themselves and by others, and developmentally co-constructed in terms of the

ways racial and mathematical identities converged or diverged. Interpreted as identities-innarratives, these accounts conveyed beliefs about how the participants viewed themselves-and who they thought they could become-in relation to learning mathematics. Specifically, the narratives show how at the sociohistorical level, the marginalization of African Americans through a history of racism, oppression, and racial hierarchies posed significant, though not deterministic, barriers against building positive and productive mathematical identities. According to Martin, interactions arise among historical practices, "being African American," and "being a doer of mathematics" that influence success and failure in mathematics. These interactions also play out at the *community level*, where narrated experiences of African American parents and community members send messages to children about what it means to be a doer of mathematics; at the school level in student's experiences within micro-cultures of mathematics classrooms; and at the *intrapersonal level* in their developing sense of themselves in relation to mathematics. This attention to multiple frames of reference for analyzing identities at various levels places the construction of mathematics identities as a phenomenon that occurs both within and beyond the classroom itself, influenced by the full range of one's identities and experiences in the social world.

Other researchers focused on identity have also elaborated on the interplay among identityconstruction at various levels and time scales (e.g., Erickson, 2004; Holland & Lave, 2001; Horn, 2008), tracing and interconnecting influences as they occur in micro-, meso-, and macro-level contexts. Bishop (2011) analyzed connections between identity construction and the moment-tomoment dynamics of discourse in a mathematics classroom using a hierarchical set of factors acting at the school level (e.g., tasks, curricula, classroom norms and structures); the interpersonal level (e.g., positioning, narratives), and the intrapersonal level (e.g., goals and

possible selves) to understand the influence of each on participants' identity construction. While the study was focused primarily on micro-level factors, the operationalizing of factors at each level presented a feasible approach to analyzing the interplay among factors at various levels. In my description of the conceptual model for my study, I will elaborate on my adoption of "identity-related factors" as a particularly useful tool for analyzing the interconnections between classroom-level identification and identities participants construct at various levels.

Summary

Students' engagement in communication of mathematical ideas has been a cornerstone subject of mathematics education reform efforts in recent decades. In this chapter I highlighted a few important strands of research related to mathematical discourse—defined in terms of communication of mathematics reasoning—as a way to demonstrate its importance with respect to both cognitive learning of mathematics concepts and the development of sociocultural identities in classrooms, both of which are folded into the design principles of the ESP workshop.

An overarching theme in this research is that even in "discourse-rich" environments where opportunities for participation in mathematics communication may be prevalent, the availability of opportunities to learn—either in terms of mathematical content or in terms of students' development of identities of participation—is not distributed equally in classrooms nor among students in collaborative groups within classrooms. Availability of opportunity to learn in classroom discourse has been found to be subject to conditions that either enhance or limit students' roles as active contributors. Conditions such as the degree of intersubjectivity in discursive exchanges, students' relative positioning and associated status, enactment of

functional roles, group composition, and tasks themselves have all been found to influence the ways discourse opportunities are made available to students. By focusing on students' own perspectives on how they navigate participation in classroom discourse through the myriad of complex factors that can influence their opportunities to do so, a strand of research has demonstrated the complexities and persistent challenges to equitable discourse that marginalized students often face even in classroom ecologies intentionally designed to support equitable discourse.

At the same time, some of this research demonstrates how in certain discursive contexts (as in a case study of a particular ESP workshop) interactions among diverse groups of students can provide opportunities for identities of participation among marginalized students. It is from this dialectical tension between the challenges of inequity in discourse and its potential for supporting mathematical identity development among marginalized students that I conduct and analyze this workshop case study, recognizing the diversity with which workshop students identify with their own opportunities for discourse. In my own research, my hope is to add to understanding in the field about how students encounter, navigate, and interpret this tension in their own moment-to-moment interactions in workshop discourse.

A goal of the present study is to generate an emergent theory in explanation of students' identification with discourse in a particular ESP workshop. I enter this exploration informed by four key considerations related to identity that are particularly useful in studying interactions within mathematics classrooms: identity as participation in a community of practice; identification in relation to norms and obligations of the community; identities as narratives; and a multi-level approach to understanding identity development as being enacted across multiple communities of practice, and across sociohistorical, community, school, classroom, and

intrapersonal levels. Put together, these framings of identity provide the building blocks for the theoretical model I adopt for this study, which will be described in Chapter IV.

CHAPTER III. AN INITIAL THEORETICAL MODEL

In this chapter, I present a theoretical model for identification with discourse in the workshop that is rooted in the theoretical frameworks discussed in Chapter II. First, I raise a caveat in describing this model at this point in the dissertation. It may seem premature to propose a theoretical model of the phenomenon in question prior to a discussion of the research design, context, and data collection methods. Proposal of an initial model would more sensibly occur at the outset of analysis, informed by some initial indications from data interpreted in light of the theoretical frameworks adopted for the study (Yin, 2003). This was, in fact, the way the research proceeded, but I position this chapter at this point in the dissertation with a specific goal in mind: to provide an overall framework and trajectory that shows where the research and analysis are heading and why. Perhaps just as importantly, describing the theoretical model at this point also provides an opportunity to define the related constructs that lie at the core of the study.

Thus, the model serves as a conceptual launch point from which emergent theory about the phenomenon of identification in the workshop will be developed in analysis. It represents a structure for analyzing and explaining students' identification with discourse, drawing from an interpretive scheme for analyzing mathematics classroom identities (Cobb, Gresalfi, & Hodge, 2009) and from Martin's (2000) multi-level framework for analyzing mathematics identities. In this model, the interpretive scheme of Cobb, et al. provides the basis for formulating modes of identification and discursive obligations in the workshop; and Martin's (2000) multi-level framework provides a basis for interpreting students' descriptions of how and why their identification modes were influenced by identity-related factors at various levels. The subsequent analysis in the study then aims to examine the viability of this theoretical model as a means of

understanding the phenomenon, and to further flesh out of the model based on emergent findings in the analysis.

An Initial Theoretical Model for Identification with Workshop Discourse

To set the guideposts for the study of students' identification with workshop discourse, I introduce a theoretical model that juxtaposes the interpretive scheme developed by Cobb, Gresalfi, & Hodge (2009) for analyzing students' development of identities in mathematics classrooms with Martin's (2000) multi-level framework for analyzing identity. I base this juxtaposition on the premise that students' identification with discursive activities can be interpreted in the workshop context using an adaptation of Cobb, et al.'s (2009) scheme, and explained by analyzing the connections students make to identity-related factors suggested in the various levels of Martin's (2000) framework.

The model assumes a relationship among discursive obligations, identification modes, and identity-related factors (Figure 3.1). Within the workshop, I contend that students encounter numerous, micro-level opportunities to fulfill discursive obligations, which are based on what it means to a student to successfully engage in workshop discourse as constituted by the workshop community. Students interpret and take up these moment-to-moment opportunities in various modes of identification including affiliation, compliance, avoidance, and resistance. In these instances (as recalled and interpreted by students in subsequent reflection), students describe their identification modes in instances of discourse as influenced by identity-related factors (i.e., narrated events, experiences, and self-understandings associated with identity enactments at the sociocategorical, community, academic/disciplinary, classroom, and intrapersonal levels). I contend that at least part of the explanation for *why* students identify with discursive obligations

as they do will be visible in the identity-related factors students invoke in their own descriptions about their participation in discourse. The IRFs are therefore shown as interconnected to discursive obligations and to identification modes to represent their salience in students' explanations of why they identify with discursive obligations as they do.



Figure 3.1. Initial theoretical model depicting students' invocations of identity-related factors as explanatory of their identification modes with workshop discourse.

An important aspect of this relationship is that it plays out mutually in the real-time context of the workshop, as well as in students' *post hoc* reflections about their workshop participation. Thus, although I describe identification in relation to micro-level, moment-to-moment opportunities within the workshop, I view identification as occurring both in those moments themselves as well as through the internal sense-making that students may do in relation to those moments. Therefore, if and as students reflect on connections to various identity-related factors in relation to their modes of identification, they may be doing so by *recalling* their interpretations and experiences from the workshop, or they may be constructing new meanings through their post hoc reflections, or else (almost certainly) both. The reflective interviews I conducted with participants represent an effort to facilitate that sense-making process, rather than as a means to capture the "truth" of what students experienced in the workshop. Relatedly, I recognize that as interviewer and researcher, I act as a coparticipant in each participant's sense-making processes, and thus in the phenomenon of identification itself as it emerges in the workshop community.

Discursive obligations

In Cobb, et al.'s (2009) interpretive scheme, the normative identity in a classroom refers to the set of expectations of what it means to be "a competent mathematics student as that is constituted in the classroom" (p. 43). Normative identity is described in terms of the closely inter-related constructs of norms and obligations. Where *norms* are defined in terms of the expectations that participants hold for each other in joint activity, *obligations* represent the complementary notion of how expectations are interpreted toward one's own actions in the community—or from the participant's perspective, *what is expected of me in relation to a given norm*. Obligations therefore entail what one believes one is expected to fulfill in order to be "competent" in the community.

Normative identity in the classroom is divided into two sets of obligations: general classroom obligations comprised of the ways students express agency and distribute authority, and mathematical obligations comprised of what "counts as mathematical competence." In the present study I narrow the focus to a particular subset of general classroom obligations explicitly related to discourse as it is constituted in the workshop, which I refer to as discursive obligations.
I define *discursive obligations* as the ways of speaking and communicating mathematically, negotiated by the community and understood by participants as what it means for them to be a successful contributor toward workshop discourse in problem-solving contexts. Defined in this way, they are perhaps akin to Esmonde's (2009a) notion of *work practices*, described as "interactional patterns that groups construct as they get work done together" (p. 251), but they encompass a broader set of discursive contexts beyond that of group work, and they bring a participant's sense of "oughtness" into consideration. I categorize discursive obligations into broad modes or routines (e.g., small-group problem solving, student-to-whole-class presentation), but in keeping with Cobb, et al.'s sense of obligations, each is constituted by the community and understood by participants in terms of what it means for them to competently fulfill the expectation.

Perhaps a detailed operationalization of discursive obligations can best be accomplished by illustration. Consider as an example the notion of "small-group problem solving." By itself, this represents a general "mode of workshop activity" that participants might refer to commonly and collectively, but it is not necessarily a discursive obligation as such. However, associated with "small-group problem solving" are some commonly described, specific expectations that participants would hold for each other about what it would mean to be a competent communicator in this context, such as "contributing ideas to solve a problem", "verifying answers together", or "paying attention to what the group is doing." These and other expectations would collectively represent the norms associated with small-group problem solving. As noted by Cobb et al. (2009), it is recognized that expectations are held not uniformly across participants. The discursive obligations, then, would represent the actions an individual participant believes himself or herself obliged to fulfill to be considered a competent "group

problem solver." In this way, one participant's obligations related to group problem solving may differ from those of another. One student might not recognize "contributing ideas" as an obligation of group work in the same way as another. This individualized aspect of obligations creates an empirical challenge to tracing obligations (instead of norms) at the workshop level. However, in my own analysis such a fine-grained classification of obligations is not necessary for two reasons. First, students' descriptions of the obligations for each broad "mode of workshop activity" were fairly consistent from student to student. Second, my research questions are more focused on broad patterns associated with obligations than on the nuances of how students understood discursive expectations differently from one another. Individual differences, in fact, were much more easily viewed in terms of modes of identification rather than as differences in understandings about discursive norms. I therefore name discursive obligations according to the broader categories of discursive activity in the workshop (e.g., "solving problems in small groups"), and include in those obligations students' more specific, commonly described understandings of the expectations they need to fulfill to be a competent communicator in that type of activity.

I focus specifically on discursive obligations for several reasons. First, classroom discourse constitutes a "primary method for shaping and conveying identities," (Bishop, 2011, p. 44) and affords visible opportunities for students to construct and enact identities within classrooms (Davies & Harré, 2001; Gee, 2005). The ways students take up or reject these opportunities provides an empirical view into how they negotiate their identities in the classroom community. Second, the establishment of structures for collaborative, discourse-based classroom routines is one of the foundational design elements of the ESP workshop. As such, the present study focuses on how students understand their discursive obligations in the workshop, and why identification

with discursive obligations might vary across situations and students. A great deal of exceptional work has already been done by others to establish a connection between the establishment of discursive, agentive classroom environments and students' development of mathematics identities. Less is known about what students view as salient in their identification with mathematics classroom discourse. By focusing explicitly on discursive obligations, I gear my analysis to address how and why students identify with discourse in moment-to-moment interactions.

Identification modes and time scales

One of the empirical aims of the study is to examine "situational" variations in identification: how identification varies as the situational features of classroom and small group discourse change (e.g., structures of discourse, co-participants, mathematical goals and content, adopted roles, relative status). I therefore document identification on a micro-level time scale, occurring within single "instances of discourse" marked by configurations of structure, participants, and mathematical task. To connote this temporary aspect of identification, I use the term *identification mode* as an adaptation of what Cobb, et al. defined as personal identity. In my adaptation, identification mode refers to whether students affiliated with, complied with, or resisted an opportunity to fulfill a given discursive obligation in a single instance of discourse the workshop.

My use of the term "identification" here encompasses all forms of personal identity (affiliation, compliance, and resistance), which is a semantic departure from Holland, et al.'s (1998) and others' use of identification as synonymous with affiliation. I adopt this shift to portray identification as occurring along a continuum extending from affiliative to resistant

modes. In addition, Holland, et al. theorize identification as a process that ultimately has individuals moving toward affiliation over time as they invest themselves in activities carried out initially in mere compliance to others. I share this view of identification, but with full recognition of the relatively long time scales that are likely involved in this progression, and leaving open the possibility that students do not always progress toward affiliation over time but may move in the opposite direction or remain static in their mode of identification. Thus within the smaller, instance-to-instance time scale of the present study, I do not expect to see—nor do I intend to document—identification playing out along a trajectory from non-affiliation to affiliation (or vice versa); rather, I focus on the variations associated with the situational aspects of classroom discourse—another rationale for considering identification as a set of distinct, operationalizable modes.

As will be described in more detail in Chapter V, based on analysis of the data, identification modes were further expanded to include a mode of *avoidance*. Thus, the complete set of identification modes is constituted as affiliation, compliance, avoidance, and resistance. I operationalize these identification modes fully in Chapter V.

Identity-related factors

In the present study, I rely on Martin's (2000) multi-level framework as a seminal conceptualization of construction of mathematics identities that can be analyzed at various levels, including sociohistorical, community, school, classroom, and intrapersonal. I adapt the framework specifically to analyze connections students make between their classroom-level modes of identification and their explanations as to why they adopted those modes in instances of discourse, which potentially reach across the sociohistorical, community, school, and

intrapersonal levels. Classifying these connections to levels in this way serves two purposes. First, it can provide clues that help characterize workshop discourse as a whole. If, for example, sociocategorical factors are invoked prominently by students from marginalized groups-or perhaps from one particular marginalized group—in their explanations of non-affiliation with discourse, there would be cause for further exploration into how the community itself might be perpetuating marginalization in ways related to racial, ethnic, or gender categories. Or if classroom-level factors were often invoked in students' accounts of discourse, perhaps related to group work structures or the mathematics tasks themselves, a different picture would emerge related to students' identification with discursive instances in the workshop. A multi-level approach provides a means to develop broad theoretical notions about what kinds of factors "matter most" in workshop discourse. Second, a multi-level analysis provides a way to further theorize about students' individual and situational differences. By categorizing salient issues students raise in their descriptions, students' identification might become interpretable in terms of their own tendencies toward one or more levels of identity enactment. Where one student might tend to view discursive instances through a "sociocategorical" lens, another might be more inclined toward an "intrapersonal" interpretation. Still others might invoke multiple levels. Each of these possibilities can potentially provide theoretical explanations for students' individualized and situationalized modes identification with discourse.

Drawing from Bishop's (2011) use of *identity-related factors* as a way to analyze students' identity construction at the classroom level, I introduce a categorization of identity-related factors that reflects Martin's (2000, 2012) multi-level framework. These categories and their corresponding levels are shown in Table 3.2. The analytical approach I take with these categories is a substantial variation from Martin's conceptualization, but this is in part due to some specific

analytical constraints. In Martin's framework, the levels suggest particular methodological approaches for researching identity at each level: classroom observation for school level, narrative interviews of parents for community level, etc. In the present study I analyze a single data set for references, explanations, and connections students make to particular factor categories. My adaptation of the multi-level framework in this way may constitute a somewhat blunt application of a deeply nuanced analytical framework, but at the same time it introduces a novel use of Martin's framework for categorizing how students invoke factors at various levels in making sense of their affiliations (or non-affiliations) with their discourse in a micro-level classroom culture.

Factor Category	Corresponding Level (Martin, 2000)
Sociocategorical	Sociohistorical
External communities	Community
Disciplinary/Academic identity	Community/School
Classroom-level Disciplinary content Conventions Positioning	School
Intrapersonal	Intrapersonal

Table 3.2. Identity-Related Factors

Sociocategorical factors. I refer to aspects of identity associated with broad social constructions as sociocategorical factors. These include the macro-level influences of social categories such as race, gender, class, sexual orientation, ethnicity, and language on the identities of individuals, particularly as they arise in micro-level classroom discourse. As the field of mathematics education has made a recent turn toward sociopolitical aspects of mathematics identities learning, connections have been documented between the development of mathematics identities and experiences of race (Larnell, 2011, 2013; Martin, 2006, 2012; McGee, 2015; Shah, 2013; Stinson, 2006, 2008, 2013), gender (e.g., Langer-Osuna, 2011; Mendick, 2005), and class (e.g.,

Lubienski, 2002). These connections largely have been analyzed at the macro-level by looking at narrative histories and broad trajectories of individual's mathematics identity development as it is shaped by the racialized, genderized, class-based, and "othering" experiences that are imposed on individuals from marginalized groups. Parallel to Esmonde, et al.'s (2009b) approach in their study on how secondary students' categorical identities influenced their opportunities to learn in group work, my conceptual model is intended to bridge the macro- and micro-levels of analysis by documenting specifically how sociocategorical factors come into play as individuals take up and reflect on their particular modes of identification with classroom discourse.

External communities. I frame the level of external communities in terms of Wenger's (1998) notion of a nexus of multimembership discussed earlier in this chapter, where identities that one develops across one's various communities of practice are viewed as mutually influential. The category specifically refers to communities in which a student participates that are external to the classroom (e.g. the family community, workplace community), disciplinary, and academic communities.

<u>Disciplinary/academic identity</u>. To define disciplinary/academic identity, I lean heavily on Martin's definition of mathematics identity:

Mathematics identity refers to the dispositions and deeply held beliefs that individuals develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics to change the conditions of their lives. A mathematics identity encompasses a person's self-understandings and how they are seen by others in the context of doing mathematics. Therefore, a mathematics identity is expressed in narrative form as a negotiated self, is always under construction, and results from the negotiation of our own assertions and the external ascriptions by others (Martin, 2009, p. 326).

Factors related to disciplinary (or mathematics identity) are represented in narrated experiences outside of the classroom that reflect students' construction of their deeply held beliefs related to their ability to do mathematics. Related to a specifically mathematical identity is a more general

form of academic identity, which encompasses an individual's beliefs about themselves and their ability to perform effectively in academic endeavors more generally.

<u>Classroom-level factors</u>. I divide classroom-level factors into three distinct sub-categories, drawing from a taxonomy articulated by Bishop (2011). The first focuses on disciplinary content, which encompasses the curriculum, tasks, and mathematical concepts and procedures that constitute the "subject" of discursive activities in the classroom. The second focuses on structural norms and conventions established in the classroom, which include pedagogical methods, organization of class time, and discursive structures. The third includes micro-level, moment-tomoment positions and roles that are taken up in discourse, which make contact with the positional identities and status issues described earlier in the chapter.

Intrapersonal-level factors. Finally, intrapersonal factors include those which Bishop (2011) categorizes as "goals and possible selves." I view intrapersonal factors in a similar vein to Wenger's (1998) and Anderson's (2007) identity mode of imagination, by which one sees participation in the community as instrumental in becoming one's "imagined self." Drawing from (Holland, et al., 1998), the intra-personal aspects of identity occur as individuals "tell themselves who they are and then try to act as though they are who they say they are." These self-understandings represent an interconnection among discourse, activity, and identity, where what one says and what one does reify who one sees oneself becoming, and vice versa. In a sense, I view intrapersonal-level factors not as fixed traits (as they are often framed from a psychological perspective) but as potentially durable across communities and contexts where they have been "thickened" over time, or where they are held with "strong emotional resonance for the teller" (Holland, et al., 1998, p. 3).

Summary

In this model (see Figure 3.1), a relationship among constructs is theorized where identityrelated factors at various levels intersect with students' modes of identification with the momentto-moment discursive opportunities that arise in the workshop. The model sets the guideposts for the empirical examination of the interrelationships between these constructs, with the particular goal of explaining individual and situational patterns and differences in identification with discourse among students within the same workshop. I stage this theoretical model not as a theory in itself, but as a starting point and guiding framework for analysis that leads to generation of an emergent theory for the case study. In studying identification with ESP workshop discourse as an unexplored phenomenon, emergent findings are likely to suggest alternative, extended, or revised theoretical explanations and interpretations. In this way, the analytical model serves to anchor and organize findings through the course of analysis, which I discuss in detail in Chapters V, VI, and VII.

CHAPTER IV. RESEARCH DESIGN, CONTEXT, AND METHODS

This study is a qualitative investigation of students' identification with discursive activities in a Calculus I workshop. The design is intended to document why students identify with the discursive practices in this workshop ecology: what collective patterns and individual differences emerge among students, and how they are interpretable in terms of identity-related factors at micro-, meso-, and macro-levels. In this section, I provide the methodological basis for using a phenomenological, explanatory case-study approach.

Research Design

The present study focuses on an individual classroom—clearly bounded in space and time. The idea of a "case," which can be understood as a "spatially delimited phenomenon (or unit) observed at a single point in time or over some period of time" (Gerring, 2007), allows analysis of the phenomenon of identification in ways that larger-scale strategies cannot (Yin, 2003). Yin further describes case study as a strategy that is particularly suited to research where "(a) 'how' or 'why' questions are being posed, (b) the investigator has little control over events, and (c) the focus is on a contemporary phenomenon within a real-life context" (p. 2). From among the myriad of research strategies available in educational research, case study is unique in that it focuses on *bounded systems*, where there is a limit to the number of participants involved over a finite amount of time (Merriam, 1998).

The focus of the research questions in this study is bounded in time by the duration of classroom activities, and in space (both social and physical) by the context of the classroom communities in which the activities occur. The research questions also focus squarely on the "how" and "why" of identification with discourse. As a phenomenological study, I am interested

in understanding events as they occur in the real-life context of the classroom, rather than investigating effects of any controlled interventions. For these reasons, case study represented a particularly strong fit for this research. Because the project is intended to investigate a single case in order to illuminate a particular issue—i.e., a single workshop to provide explanation of students' identification with discourse—the case study will be conducted as an *explanatory* case study (Yin, 2003), intended to establish theoretical understandings in explanation of students' identification with discourse as it occurs in the localized context of an ESP workshop.

A key design issue involves how the case will be defined in relation to the activities and classrooms being studied. I define the case as the workshop classroom, based on the goal of understanding how identification occurs for different students in different situations within the single system of the workshop in which all students participate. As such, this study is a case of why individual differences in identification occur among participants in a discursive, mathematics workshop, with a focus on the role that identity-related factors plays in explaining those differences.

Research Context

The research site for this study was an elective Calculus I workshop, instituted as part of a large, urban, public university's Emerging Scholars Program (ESP). The program is widely known in the post-secondary mathematics education community as a hallmark approach to supporting African American and Latinx students' success in introductory mathematics and science courses (Asera, 2010), and based on its well-documented implementation of collaborative, discursive environments in which students solve challenging problems. In this section I first provide an overview of the university site itself, followed by a description of the

local implementation of the ESP workshops. I then describe the specific context of the Calculus I workshop classroom where the study was conducted.

The university site

The research took place in a large, four-year state university in a midwestern metropolis during the spring semester of the 2014-15 academic year. The university is a comprehensive, four-year, tier-1 research institution, offering 85 bachelor's degree programs and nearly 200 graduate-level and professional programs. The school's mission as published on the university website portrays a commitment to serving the local urban community, fostering "scholarship and practices that reflect and respond to the increasing diversity of the U.S.", and providing academic opportunity to a "wide range of students". According to the university's *Student Data Book*, in 2014-15 the overall student body was distributed equally by gender, 50% female and 50% male. Although enrollment data across all STEM-related majors was not available, in the College of Engineering, 84% of enrolled students were male and 16% were female. If taken as a rough indicator for STEM-related programs university-wide, this figure suggests a wide gender disparity reflective of the overall historical trend in STEM fields.

The university reported racial/ethnic distributions for the 2014-15 academic year as shown in Table 4.1. These distributions are relevant to the study, particularly in the under-representation

Enrollment Group	Am. Indian & Alaska Native	Asian	Black or African American	Hispanic/ Latino	Native HI or Pacific Islander	White	Multi- racial or Other
Total	0.1%	18%	8%	19%	0.2%	40%	4%
Undergraduate	0.1%	23%	8%	26%	0.3%	36%	4%
College of Engineering	0.1%	24%	5%	19%	0.3%	42%	5%

Table 4.1. University Racial/Ethnic Distributions, AY 2014-15

of non-Asian minority students in a large city whose overall population is, according the US Census Bureau, was approximately one-third Black and slightly less than one-third Hispanic. Of these demographic data, the enrollment disparity of African American students in engineering programs at the university site is perhaps the most striking at 5%. Put together, these distributions indicate that in STEM-related courses, African American students, Latinx students, and female students will encounter low numbers of peers from their own racial, ethnic, and gender categories.

The university provides support, services, and opportunities for community building among students through a number of campus organizations for African American, Latinx, and female students. Several participants in the study reported engaging with these organizations at various levels of consistency, primarily to seek academic support and guidance counseling, or simply to socialize and confide with other students from these groups at the university. In short, despite the university's public commitment to diversity and providing opportunities for success to a "wide range of students," enrollment numbers would indicate that students from underrepresented groups will often be one of only a few students from their race or gender category in their academic programs and in many of their courses, particularly those related to STEM fields. This persistent phenomenon is directly tied to the university's initial adoption and ongoing implementation of the Emerging Scholars Program.

ESP implementation at the university site

The ESP program was instituted at the university site in 1989, during a period when the PDP workshop model (see Chapter II) was being widely disseminated in colleges and universities across the nation (Oppland, 2010). As was generally the case for new implementations, the

university site initially adopted the program with the goal of supporting students' success in introductory "gatekeeper" mathematics courses in STEM programs. The workshops were intended for any students who wished to enroll, reflecting the broader design principle of creating a diverse community of learners within the workshops. At the same time, the overall effort was geared toward improving success rates of African American and Latinx students in introductory mathematics courses, and consequently, toward completion of STEM-related degrees. Research conducted at the university site on performance of minority students in STEM fields at the time indicated a similar pattern to that encountered by Treisman (1986) in his initial study at Berkeley: namely, that African American and Latinx students were disproportionately unsuccessful in introductory, path-critical mathematics courses, and therefore experienced high rates of attrition in STEM-related degree programs. From data collected in 1989, more than half of all students from these groups at the university site were failing precalculus and approximately one-third were failing calculus.

Since its initial implementation at the university site in 1989, students in the program have consistently outperformed those not in the program on measures of mathematics grades, grade-point-average, and graduation rates (Brugueras, Hernández-González, and Libgober, 2005), motivating the continuation and growth of the program in the mathematics department. From the handful of precalculus and Calculus I workshops offered in 1989, the program has expanded in the number of sections offered, the courses supported, and the students enrolled. In the Spring Semester of 2015 (the semester of the present study), ESP workshop classes were offered to accompany 5 different mathematics courses at the university site: precalculus (4 sections), Calculus II (3 sections), Calculus III (4 sections), and an introductory

course on theoretical mathematics for mathematics majors focusing on writing proofs (2 sections). Class sizes in these sections ranged from 8-19 students.

Workshop classes at the university site meet for 1 hour and 50 minutes per session, two times per week for Calculus I and II workshops, and once per week for all other corresponding courses. Workshops are entirely voluntary and are not a required course in any academic programs. The course is graded as satisfactory/unsatisfactory, typically based on the instructor's criteria about attendance and/or participation. Students receive one credit hour for satisfactory completion. Recruitment of students to the workshop occurs in a variety of ways. A standard email is sent from the program coordinator to all students who have registered for the corresponding mathematics courses, detailing the purpose, philosophy, benefits, and expectations of the program. Instructors of the corresponding lecture sections and discussion sections also actively recruit during the first few class sessions of the semester. In addition, academic advisors often recommend enrollment for students taking precalculus (considered a remedial course in mathematics sequences for STEM majors), or for students who had been unsuccessful in a credit-bearing course they had previously attempted. Several students in the study also reported hearing about the program through campus outreach organizations for African American and Latinx students.

The ESP program is overseen by the Director of Advising and Outreach from within the university's mathematics department. The ESP coordination duties comprise a significant portion of the roles and responsibilities of this position, and include recruitment of students; scheduling or courses; assembly and distribution of course materials (i.e., the problem worksheets); and the selection and training of instructors for the workshops. Instructors are typically selected from graduate teaching assistants in the mathematics department, often based on evidence from their

previous teaching about their dedication, enthusiasm, and student-centered approach (Oppland, 2010). Initial training is provided to workshop instructors related to the model, philosophy, and instructional approach of ESP. Depending on the number of students enrolled in a section, an undergraduate assistant—typically a high-performing, third- or fourth-year mathematics or mathematics education major who participated in ESP as a student—can be assigned to support the instructor.

The ESP workshop classroom

The research site for the study was a Calculus I workshop, taught by a single instructor with a total of nine students enrolled. Class met two times per week on Tuesdays and Thursdays from 1-3pm. This particular workshop section of 9 students was smaller than most ESP workshop sections, where up to twenty students can be enrolled. The reason for this disparity was not known to the researcher, though it may have been related to this being the instructor's first year teaching the workshop. At the outset of the semester, eleven total students were enrolled in the class. Within the two weeks, two students had either dropped the course or transferred to another section, both of which are common occurrences early in the semester. Each workshop session typically was attended by all but perhaps one, at times two, of the nine total students. There were a few exceptions, as on days immediately preceding or following a Calculus I exam for example, when attendance was lower.

Workshop sessions were held in a second-floor classroom of a relatively small, three-story, concrete-and-glass building near the center of campus. The building space consisted of small classrooms used for core undergraduate mathematics courses, with a few rooms allocated for common space and a computer lab. The physical space of the workshop classroom was stark and

simple: a small wooden teachers' desk in the corner with an overhead projector and tall stool beside it, a dusty green chalkboard spanning one of the unpainted concrete-block walls, and another wall consisting of a row of floor-to-ceiling vertical window slits separated by concrete mullions. On cold days, radiators along the baseboards clanked and hissed. Spread about the room were freestanding student desks, often clustered in small groups or at times arranged in semi-circles or rows, depending on the activity that had occurred during the room's previous use.

At the start of a typical session, the instructor would greet students as they entered the class and hand them a sheet with the problems for the day. The worksheets, which were provided to the instructor by the ESP coordinator, consisted of anywhere between four and eight type-written problems, often with multiple parts each (see Appendix A for a sample worksheet). As discussed in the previous section, the problems were not constructed with the intention of remediating prerequisite content or skills, nor were they designed simply to provide extra practice. Rather, the problems represented rigorous and challenging tasks focused on underlying concepts aligned to the Calculus I course. This represented an ESP design feature noted by several students in their interviews, in which they described how, once they were able to solve the workshop problems, the homework and exam problems in the calculus course seemed surprisingly less difficult by comparison.

Once students settled into their seats, the instructor arranged them into small groups to begin working on the worksheet problems. During the earlier part of the semester in particular, the instructor took on a more directive role in assigning students to groups, reminding them to work together and talk about their solutions to the problems, and pacing students' progression through problems. As the semester progressed, the workshop tended to proceed in a more organic way, with students establishing their own groups and taking a more self-directed pace through

problems. Thus, students were allowed to approach group work in ways that varied over time and across groups. At times groups of students could be observed sitting together but working individually, at other times checking in with each other on work they had completed individually, and still other times engaging in more animated discussions as they collaborated on solutions in real time. On occasion, groups intermingled or engaged in group-to-group crosstalk, comparing solutions or asking specific questions of each other. Typically, the instructor would circulate to check on students' progress, ask questions of students, and respond to their questions. From time to time, students could also be observed engaging in off-task discussions, checking their cell phones, or sleeping in a corner of the room. These behaviors were seldom engaged in by more than a few students at a time, and at the surface seemed to be ignored by the students who were engaged in problem solving.

While small group work was the primary mode of instruction in the workshop, others forms of interaction were common as well. Usually after students had worked through a subset of problems from the worksheet, one or more students would either volunteer or be asked by the instructor to present a solution at the board. This would involve the student writing down the solution and then explaining what they had written. Often the instructor or other students would engage in discussion with the presenting student by asking questions, making a correction, suggesting an alternative strategy, or providing a suggestion to help move a solution forward. At times, students would present at the board not having completed a problem. This was often the case for particularly challenging problems for which no students or groups had arrived at a solution. In these instances, a discussion would ensue among most or several students and the instructor to arrive at a solution. On other occasions, the instructor directed whole-class discussions more explicitly. Philippe, for example, tended to adopt this mode on occasions where

he noted a common difficulty or misconception across students or groups that he addressed directly. In this mode, Philippe would typically adopt an initiate-response-evaluate approach to whole-class discussion, which he led from the front of the room.

At times, other less-common scenarios emerged in the classroom, as on several occasions when multiple groups of students would huddle together at various locations along the blackboard, organically discussing questions and difficulties related to problems that had already been presented. On another occasion following a calculus exam when only six students were present, the students arranged their desks in an impromptu discussion circle to recap the questions on the exam and "blow off some steam," as one student described it. In each of these modes of interaction, students and instructor established a set of norms related to discourse. These norms formulate the beginnings of the case study analysis to be discussed in Chapter V.

Recruitment and Selection of Participants

In November of 2014, I met with the coordinator of the Emerging Scholars Program in the university's mathematics department to discuss the possibility of conducting research in one of the workshops for the following semester. In the meeting, we discussed implementation of the program at the university and its potential as a research context. With approval of the coordinator, I made several informal visits to two Precalculus and three Calculus I workshops during the first two sessions of the Spring Semester. I chose Precalculus and Calculus I workshops because of their association with introductory level mathematics courses, which according to the coordinator, were the "gatekeeper" courses where students were most at risk of dropping out or falling behind in the critical mathematics course sequences for their STEM-

related majors. These five sections were initially chosen based on the class schedule and my own availability.

I conducted the initial visits to further establish the appropriateness of fit of an ESP workshop classroom for the study, and then to develop a short list of sections/instructors that I would recruit for participation. In my initial observations, I noted a range of implementations that reflected the core principles of the ESP program in varying degrees. For recruitment purposes, I was particularly interested in classrooms that included the use of the prescribed problems as the primary "curriculum" for the course, the facilitation of a variety of collaborative structures, and the allowance for students to direct much of their own learning and problem solving. I also sought a classroom with a diverse make-up of students according to categories of race and gender, prioritizing the inclusion of African American, Latinx, and female students in the case-study class. Two out of the five classrooms I observed were particularly well aligned across all of these criteria. There were 22 students in one of these classrooms and 11 students in the other. Again with the coordinator and instructors' permission, I proceeded to formally recruit in both of these classrooms, and would make a decision on which classroom to select based on how many, and which, students consented.

At the beginning of the third class session of the semester, I presented to each class a fiveminute overview of the purpose and activities of the study, participant commitments, compensation, and informed consent procedures. I distributed consent forms to the students and instructors and collected them following the two-hour session, letting all potential participants know that they may or may not be selected for final participation. Eight students and the instructor consented to participate in the smaller section; four students and the instructor consented from the larger section. Based on consent rate, as well as the greater diversity of

consented students in the smaller section, I selected this section as the case-study site. All 8 consented students and the instructor were enrolled in the study in order to maximize the diversity of participants, and to be able to represent the classroom case study as fully as possible in the data collection, particularly given its small size. This approach also allowed for strategic selection of individual student subcases on which to conduct a more detailed analysis. With data collected from a larger group of participants, subcases could be chosen to elicit particular aspects of identification with classroom-level discourse addressed in the research questions. During the fourth class session of the semester, I began scheduling interviews with all 8 consented students and conducting classroom observations.

Research Participants

Student participants

Out of the 9 total students who remained enrolled in the workshop class over the entire semester, 8 participated in the study along with the instructor. Table 4.2 provides a description of the participants. The majority of participants (6 out of 8) were male. Of the eight students, four identified themselves as Asian, two as African American, one as Latinx, and one as white. All of the students were undergraduates, all but two in their first year at the university. Griffin and Kaytlin were slightly older than other students in the class. Griffin's progress in his mathematics course sequence was slowed by several changes in his major, and by his not receiving required grades of C or better in his introductory mathematics courses prior to and including Calculus I. Kaytlin had spent several years in a community college program before transferring to the university and changing her major.

In some respects, these students all represent success narratives by virtue of their acceptance into a STEM-related program in a major four-year university. At the same time, all of these students report of their own struggles with the substantial academic demands of these programs, particularly related to mathematics. All but two of these students reported enrolling in the ESP workshop because of unsatisfactory past performance in Calculus I, the first credit-bearing mathematics course requirement in most STEM-related majors offered at the university (i.e., a grade that was not accepted for continuation in the mathematics sequence for the program, generally a requirement of C or better). For most of these students, the mathematics requirements extend beyond Calculus I, and well beyond for engineering and computer science majors.

Students reported enrolling in the workshop for extra support after receiving a non-passing grade (below C) when they enrolled in the course previously. This was the case for all but two students, Kaytlin and Sam. Kaytlin specifically cited the need to build time into her busy work/academic schedule to study for a course she knew would be challenging. Although Sam had not taken the course previously, he was concerned about his preparation to succeed in calculus without additional support, particularly because he was homeschooled and largely self-taught in secondary-level mathematics to that point.

Instructor

The instructor for the workshop, Philippe, was a 28-year-old full-time, international graduate student working on his Ph.D. in mathematics at the university. He spoke fluent English with a pronounced French accent, but students never indicated difficulty understanding him. Philippe's demeanor in the classroom was that of an affable, knowledgeable, patient teacher. One of his primary concerns in the classroom was creating a safe environment where students would be able to learn from mistakes, evidenced by his persistent reminders for students to explain what they

			10	<i>Die</i> 7.2. Re	escuren 1 uniterpunis		
		Solf identified Pass		Under-		Repeating	
Name	Gender	and/or Ethnicity	Age*	Year	Major	I?	Reason cited for ESP enrollment
Ajay	Male	Asian: Indian descent	19	1 st	Computer Science	Yes	Improve on prev. Calc I performance
Griffin**	Male	Black: African American, Central American descent	21	3 rd	Undec. (considering Computer Science)	Yes	Improve on prev. Calc I performance
Justin	Male	Asian: Filipino descent	20	2^{nd}	Kinesiology	Yes	Time / Improve on prev. Calc I performance
Kaytlin**	Female	White	23	1^{st}	Earth Science	No	Time
Marco	Male	Latinx: Mexican descent	19	1 st	Chemical Engineering	Yes	Improve on prev. Calc I performance
Sam	Male	Asian: Indian descent	19	1 st	Mechanical Engineering	No	Prerequisite math knowledge
Vik	Male	Asian: Indian immigrant	19	1 st	Undec. (considering Biology or Psychology)	Yes	Improve on prev. Calc I performance
Whitney**	Female	Black: African American	19	1 st	Chemistry	Yes	Improve on prev. Calc I performance
Philippe***	Male	Black: International	28	Grad	Mathematics	N/A	N/A

Table 4.2 Research Participants

*

As of beginning of semester of study on January 15, 2015 Students for whom a detailed subcase analysis was conducted and analyzed (see Chapter VII) **

Workshop instructor ***

are thinking and not to be afraid to make mistakes as they attempt to solve problems. Philippe interacted with students both individually and in whole-class discussion by asking questions, even in response to students' direct questions of him. On occasion, he would provide more directive instruction toward a problem solution, though more as the exception than the rule.

According to Philippe, he only took this approach when time constraints required that the class wrap up one problem in order to move onto the next. His teaching approach aligned with what he shared with me in informal conversation about his philosophical approach to ESP. Specifically, he shared in informal conversation that he volunteered to teach the workshop the previous semester because he thought he understood and appreciated the goals and values of the program, and that he perceived students working together as the best way for them to learn difficult concepts.

Data Sources

The overall data collection strategy was intended to address the guiding questions for the study, restated here:

- How do students describe their *identification* in moment-to-moment instances of discourse?
 - a. What modes of identification do students describe with *discursive obligations* in the workshop?
 - b. What patterns or variations emerge in identification across students, situations, and/or particular discursive obligations in the workshop?
- 2) What *identity-related factors* are invoked in students' explanations of their identification with workshop discourse?

- a. What patterns or variations emerge in how factors at various levels (i.e., social categories, external communities, academic and disciplinary, classroom community, and intrapersonal) influence students' identification?
- b. How do these factors account for individual and situational differences in identification?
- c. How do students invoke these factors to make sense of their own participation in workshop discourse?

Data were collected through videotaped classroom observations, narrative interviews, and stimulated recall interviews. Table 4.3 provides an overview of these data sources, and relates each source to the goal(s) it was intended to address. The table also indicates whether a data source was the primary data source for a particular goal.

Observations

Videotaped observations were conducted for ten of the workshop sessions, distributed at roughly equal intervals across the first 12 weeks of the semester. During each observation, two stationary cameras and one hand-held camera were used. The stationary cameras were positioned strategically to capture small-group work involving student participants. At times the stationary cameras were repositioned in response to group movements, to transition to a different group, or to "pan out" to capture inter-group interactions or whole-class discussions, depending on the current activity. The hand-held camera was used more adaptively to move about the classroom in order to capture "key instances of discourse" that might not have been captured on the stationary cameras. Because I prioritized videotaping with the handheld camera during classroom

observations, informal field notes were recorded during down time, breaks, or immediately after observations. In field notes I recorded basic information about each observed session, including attendance, seating arrangements, and overall flow of activities during the session. I also recorded memos noting key moments in discourse for future video analysis, and as a way to summarize patterns or notable deviations from expected patterns related to students' participation in discourse. Observations focused both on how students participated in classroom discourse (e.g., amount and content of discourse they are contributing, body language, indicators of active listening, contributions to problem solutions, and "off-task" discourse unrelated to prescribed task) as well as any "meta-level" discussion students engaged in with peers or the instructor during workshop sessions about their own participation or non-participation).

Phase-1 Interviews

For each student participant, I conducted two "Phase-1" interviews of approximately 45 minutes each, occurring between the 4th and 8th week of the semester at prescheduled times outside of class. The primary purpose of these interviews was to orient the researcher toward key aspects of students' identities both inside and outside of the workshop community, which might be relevant in their identification with workshop discourse. The interviews were also intended to establish background information about participants, including their age, year in school, major, location of residence, previous schooling, family members, etc. The protocol for the phase 1 (see Appendix B) was designed to facilitate students' narration about: 1) their sense of self, personal identity, and social history (e.g., *What is important and meaningful to me? How do I see myself in the world, in my family, in my community? How do others in the world see me? Who do I see myself becoming in the future?*); 2) their mathematics identity (e.g., *Are you good at*

	Frequency /		
Source	Quantity	Focus of data gathering	Guiding Question(s)
Classroom observation (field notes and videotaping)	Ten (10) sessions, 2 hrs each, dist. evenly across first 12 wks of sem	 Focus on discourse of eight (8) participants plus instructor, with attention to: Classroom norms and obligations related to discursive activity Students' participation in student-student discourse and teacher- student discourse 	Questions 1 and 2
Interview: Phase 1	Two (2) 45-min interviews with each student participant (~weeks 4-8)	 Focus on each of the following themes: Background information (age, year in school, major, location of residence, previous schooling, family members, etc.) Descriptions and opinions about ESP workshop thus far Mathematics identity and dispositions toward mathematics Participants' identity in the world outside of the workshop classroom In what "figured worlds" does the student live and participate? How does the participant construct his/her identity within and across these figured worlds? What meaning/value does the participant ascribe to these worlds? 	Question 2
Interview: Phase 2	One (1) 1-hr 15-min interview with each student participant (~weeks 6- 10)	 Interviews with each participant, focusing on the following: Participants' descriptions of their overall participation in workshop discourse thus far Participants' descriptions of specific "instances of discourse" viewed on videotape Connections participants draw between their participation and their identities across figured worlds 	Questions 1 and 2
Classroom artifacts	Each observed session	 Provide contextual data about students' participation in workshop activities, primarily to support students' recall during phase-2 interviews: Photographic records of problem worksheets used during sessions Photographic records of select samples of student work 	Questions 1 and 2

Table 4.3. Data Collection

mathematics? Are you a "math person?" Do you see mathematics in your future? Is mathematics important and meaningful to you?); and 3) meaningful communities of practice in their lives (e.g., Who is important in your life? What groups do you "belong" to? What activities do you do? How do you spend your time? What is worth doing to you? What are you "good at?" What do you want to become "good at?" What do you want to become a part of?).

As part of the phase-1 interview, students completed a rating sheet in which they prioritized the relative importance of various groups and communities in their lives (see Appendix C). These ratings were then used during the interview to prompt further narration about the communities students prioritized as most important in their lives.

Phase-2 interviews

During the phase-2 interviews, students reflected on videotaped excerpts of their own participation in workshop discourse. Each student participated in one extended (1.5 hour) interview in which they were shown approximately seven (7) different video excerpts of themselves participating in workshop discourse across several sessions and types of activities common to the workshop (small group work, whole-class discussion, presenting at the board, etc.). Phase-2 interviews were also conducted at pre-arranged times and locations outside of the workshop sessions.

The protocol and method for phase-2 interviews followed a method referred to as *video modeling* (Katsopolous, 2010), in which students view themselves participating in discursive activities and reflect on their own participation. Katsopolous (2010) conceived of the method as a way for both students and teachers to move toward enacting more equitable forms of discourse in small-group contexts. Video modeling represents a particular version of a more broadly implemented method of

qualitative research categorized as *stimulated recall* (Bloom, 1954; DiPardo, 1994; Rose, 1984), in which a participant is filmed engaging in a task of interest, and then shortly after is asked to reflect on the processes used during the task, often with specific prompts intended to help the participant focus on particular processes of interest in the account.

<u>Video selection</u>. A key element in the design of phase 2 was the selection of video excerpts to have students reflect upon in the stimulated recall protocol. Video data was parsed following each observation for clips meeting a set of selection criteria discussed below. Excerpts were spliced from the full data set using video editing software, generally in lengths of 2-5 minutes. This range of length was typically sufficient to capture a potentially meaningful, self-contained exchange of discourse for the student to reflect on. An initial set of approximately 15 excerpts was selected for each student in a first pass of the video data, from which between 6 and 8 were selected for use in the phase-2 interview.

Several considerations guided the selection process to align with the goals of the broader study. Because I intended to gather data on how students identified with particular modes of discourse, the excerpts needed to reflect a representation of the primary types of activities (small-group work, board work, etc.) in which opportunities to engage in discourse were, or else could have been, taken up by the student. The excerpts also needed to represent a cross-section of students' various ways of engaging in discourse. For example, if a student was observed at alternative times acting as a vocal contributor, as a quiet bystander, or as an active listener, I attempted to capture all of these across the excerpt samples. Additionally, I prioritized excerpts to represent with whom students most typically engaged in discourse.

To summarize, I prioritized selection of video clips that were broadly representative of how, when, with whom, and under what circumstances each student participated in workshop discourse.

At the same time, I allowed for the selection of some excerpts that represented notable anomalies to students' more typical patterns of discourse, recognizing that potentially revealing connections might emerge when students describe why they acted differently from how they normally would in a particular circumstance. It is also important to note that while each of these priorities was enacted in the selection process, it was impossible to capture all possible combinations of how, when, with whom, and under what circumstances each student participated in workshop discourse. I considered this an allowable limitation to the selection process because the video prompting was not intended to match identification to a comprehensive set of variable combinations, but rather was aimed at stimulating students' reflections toward what they saw as the important factors related to patterns of identification with workshop discourse.

<u>Phase-2 interviews</u>. Interviews were conducted as close in time as possible to the observed activities to maximize students' recall of their participation, although scheduling constraints meant there would be gaps of time from two days to several weeks between the videotaped lesson and the phase-2 interview. The time gaps were mitigated to some degree by providing students with reminders of the context around each video, including the date, presentation of a printed copy of the problem they were working on, photographs of their own written work being completed during the videotaped discourse, and/or a summary of what had happened immediately prior to the clip being shown.

Each interview began with an overview of the "ground rules" of how the interview would proceed, where it was explained that students would be viewing approximately 7-8 video clips taken of themselves participating in workshop activities, and that they would be asked a few questions about each, which would require some reflection. Students were also encouraged to ask clarifying questions about the clips to refresh their recall of the context and mathematical content. Next,

students were shown each of the videos in chronological sequence on the researcher's laptop, with the video files accessed remotely from the secure, approved server on which video data was stored. After viewing each video excerpt, students would be prompted to reflect on what they viewed. Question prompts in phase 2 generally focused on *why* students participated in discourse in particular ways. The primary lead-in question following a video excerpt was, *"What did you notice about your participation in this clip?"*

From that point, reflections on each clip proceeded in an open-ended fashion, with the researcher facilitating students' drawing of connections between their participation in discourse and the broader themes of identity that may have emerged from the phase-1 interview. Most often this was simply prompted by various forms of the question: *Why do you think that is*? in response to the student's previous noticing or reflection. At times, however, more directive questions were asked if it seemed there was a potential connection to a theme from the phase-1 interview that students did not make on their own (e.g., *"In the first interview you talked a lot about the challenge of being a female who was good at math in high school. Did that come into play at all here?"*) I followed a relatively strict guideline of delaying such explicit suggestions of identity-related factors until it was clear that a student was not going to raise a potentially salient (from the researcher's perspective) factor on his or her own. At that point, I would ask about the factor and explicitly encourage the student to either reject it as not relevant to the instance or else explore it further.

Collection of artifacts

Classroom artifacts and students' written work from case-study activities (both in-class work and related homework) were collected primarily to provide context for students' during the phase-2 interviews.

Researcher positioning

My positioning as a white, male, mid-career researcher created a distinct set of challenges for conducting this research in a classroom of college-age students from a diverse set of backgrounds and social categories, particularly as I investigated issues of race, gender, and class as salient to the students' participation in discourse. Recognition of the status associated with my own membership in privileged groups brought with it an understanding of the various meanings students may have attributed to my presence in the classroom community and my interactions with them. Because issues of race and gender were part of the lived experiences of the students, teacher, and myself, they influenced each of our perspectives toward one another. Differences in status and lived experience between participants and researcher certainly influenced how students might have participated during observed class sessions, and how they responded during interviews. I expect, for instance, that some students may have felt uncomfortable or mistrustful in sharing their personal experiences. As a university researcher whose presence is endorsed by the school administration and classroom teacher, I am also positioned with a level of institutional authority. Students may have questioned why it was in their interest to share privileged information about themselves and their participation in a university sanctioned workshop course. They may have been concerned about risks of participation, or simply have wondered "why this white, middle-aged man wants to know."

At the same time, I brought my own personal history, perspective, and racial identity into the classroom and the interview room. Having grown up in a largely homogenous, white neighborhood in the city where the study took place, I experienced a pervasive discourse about race borne out of the city's highly segregated geography and social structure. I realize that despite my intentions, with my personal history comes a great deal of naiveté about students' diverse experiences in general, and

in particular among students of color and female students in STEM majors. Their lived experiences differed vastly from mine, and their perspectives took me to unfamiliar places. As such, I engaged in this research as a learning process, conducted largely from the position of "outsider."

The literature on researcher positioning discusses both advantages and disadvantages to interviewing/observing with outsider status. Outsiders often lack access to participants, and building trust can be difficult if researchers are viewed as "social intruders" who are uninvited and unwelcome (Shah, 2004). This lack of access can be exacerbated where power differences exist between researcher and participants. When this is the case, power structures can become a means whereby participants are subjugated to roles and identities because of the ways they are positioned by those with power (e.g., Holland & Leander, 2004). At the same time, outsider researchers can achieve acceptance as a person who can be taught (Rubin & Rubin, 1995). This teaching-by-participant not only helps to level the power dynamic between researcher and participant, but it can also bring to the surface meanings that might otherwise be taken for granted.

One approach I adopted to create more balance in the participant-researcher relationship, and to build trust with a researcher of outsider status, was to negotiate interviewing as a collaborative process (Merriam, et al., 2001), as opposed to a more traditional approach where the interviewee is regarded as a "passive 'vessel' that supplies answers to the interviewer" (Holstein & Gubrium, 1995, pp. 7–8). I established this collaboration through the process of "active interviewing" (Holstein & Gubrium, 1995), where interviewing involved the co-construction of meaning between interviewer and participant through a mutual give-and-take, and where the participants' knowledge and agency was foregrounded in the process. This approach entailed building rapport by validating participants' experiences, fears, and concerns with empathy and openness. It also required that I strove to

understand how participants made meaning of their experiences, while at the same time being candid with the participants about meanings I did not understand from the perspective of an outsider.

Analytical Approach

Workshop-level analysis (whole case)

Discursive obligations. The data used to document the discursive obligations in the workshop included the field notes and video recordings of the observed class sessions and the transcripts from interview phases 1 and 2. The goal of analysis was to identify the discursive obligations established by classroom participants, what specific kinds of activities were associated with each obligation, and what students' understandings were of the obligations and the associated activities they entailed.

To begin, I reviewed classroom video to identify an initial set of between four and eight categories of discursive obligations across all classroom observations. With these initial categories I attempted to capture the broad modes of activity that availed opportunities for collaborative discussion among participants, such as small-group work, whole-class discussion, etc. I then applied these categories as direct codes to video segments. Using a constant-comparison approach, I recoded the videotape in several passes to revise and refine the broad set of discursive obligations categories, ultimately arriving at a final set of 5 discursive obligations listed as D1 through D5 in Table 5.1 of Chapter V.

Because obligations are defined according to the way they are constituted and understood by classroom participants, interview data was necessary to further analyze the discursive obligations. I therefore coded the transcripts of interview phases 1 and 2 according to the five discursive obligations, noting instances from students' interviews in which they referred to participation in discourse and documenting how they described the obligation and the context in which it occurred.

In this way, I triangulated the researcher's perspective from observations with students' descriptions, further refining my own observed categories to fit students' descriptions. Furthermore, from the interview data I established sub-codes for each discursive obligation to describe in more detail how participants defined and understood these obligations (see 5.1, Chapter V).

Modes of identification. To document students' modes of identification with respect to discursive obligations, I again used the observation video and the transcripts from interview phases 1 and 2. Drawing from Cobb, et al. (2009), I began with a set of identification modes defined by the three types of personal identities described in their analytic framework of classroom-based identities: affiliation, compliance, and resistance. I operationalized these modes from the descriptions of each in the analytic framework (see descriptions in Table 5.2, Chapter V) and began a process for coding them in the classroom video data. It is important to recall from the Chapter III, however, that identification involves internal processes that generally are not directly observable in classroom discourse. The observation data thus only served to inform my own informal hunches about students' identification with discourse; formal documentation had to be carried out from the interview data. To do so, I first developed a set of what Engeström & Sannino (2011) refer to as rudimentary linguistic cues for each identification mode. In Engeström and Sannino's terms, these are simple expressions or straightforward narrative forms that help one locate potential manifestations of a construct in discourse analysis. The cues are not the same as a manifestation, but provide an indicator that may lead to the form of interest. Once I defined a set of linguistic cues for each mode of identification, the cues could be easily located within the transcripts from each interview. The surrounding text could then be analyzed more closely to identify manifestations (which I refer to as instances) of each mode of identification. It should also be clarified that I only coded an identification mode to instances that were already coded as indicating a discursive

obligation. For example, if in an interview a student indicated affiliation with the act of looking out the window during class, this would not be coded as "affiliation" because the act with which it was associated—window gazing—was not related to any of the 5 discursive obligations.

<u>Identity-related factors.</u> The goal of analysis related to identity-related factors was to understand what patterns might exist in how students interpreted their own participation and identification with discursive norms. In what ways, for example, did students' reflections about their participation in workshop discourse focus on factors related to the local ecology of the workshop itself? On their membership in communities outside of the workshop? Were sociocategorical identities invoked in their explanations, and if so how? How were intrapersonal identities invoked? Did other unexpected themes emerge in their explanations?

In both phases of interviews, students were asked to describe their participation in workshop activities: as a general reflection of the workshop overall (phase 1), and in response to viewing videotaped episodes of themselves participating in particular activities (phase 2). In both cases, students' descriptions were followed up with questions intended to elicit reflection about why they participated in the ways they described. Often, secondary follow-up questions were asked to probe for "explanations of explanations," and to elicit connections among identity-related factors acting both inside and outside of the classroom.

From transcripts of these interviews, students' narratives were initially analyzed using open coding to establish a set of identity-related factors grouped into larger factor categories. The theoretical basis for these categories was explained in Chapter III. Analysis began with a set of category codes that reflected each level from Martin's (2000) multi-level framework of mathematics identity analysis. Factors were initially coded from the interview data as they related to participants' identities at each level. For example, a participant's reference in an interview to her family
upbringing was coded as reflecting "family identity" within the category of "external (to the classroom) communities". A full list of factors and categories was established through several iterations of refinement in coding and categorizing (see representation in Table 6.1 in Chapter VI).

Initially, all references to identity-related factors were coded in transcripts from both interview phases. The phenomenon of interest, however, was the mutual influence between identity-related factors and identification with discourse. I therefore focused on documenting the s of factors and identification modes using a cross-coding technique. This process resulted in the documentation of identifiable, discreet, and situational instances in which participants identified with discursive obligations in particular modes, and explained the instance in terms of identity-related factors. Conversely, if a student made no connection between an identity-related factor and his or her identification with discourse, the instance was not included in the analysis.

Student-level analyses (subcases)

The preceding classroom-level analyses were trained on the case study as a whole, and were intended to document constructs and trends related to the process of identification across participants. Subcase analyses of individual participants were needed to understand the internal processes of identification that might further explain individual differences among students.

I began this analysis by selecting a subgroup of "focus students" from the eight student participants. Observation and interview data from these students would be studied in more detail and documented as subcases that focus on the individual-level processes of identification with discourse. At its historical roots and philosophical core, the ESP workshop was largely (though not exclusively) intended as a social and academic support structure for under-represented groups of students in STEM fields. One of the goals of this study is to understand processes of identification with

mathematics discourse, particularly for those students whom the workshop was primarily designed to provide support. Out of the 8 participants, I chose to conduct subcase analyses for Whitney, an African American female student; Griffin, an African American male student; and Kaytlin, a white female student. These particular students' narratives in the phase-1 interview depicted rich variations in the role sociocategorical factors (i.e., race, gender, and class) played in their lives and in the construction of their identities. As such, this subgroup of participants was uniquely situated for analysis of the connections they drew between these sociocategorical factors and classroom level discourse.

The first step of analysis was to document these three students' broader identities across various contexts and communities both inside and outside of the classroom. To do so, I drew from Sfard & Prussak's (2005) analytical approach of documenting narrative as identity. In the phase-1 interviews (and less frequently in the phase-2 interviews), students narrated stories about themselves in relation to various communities across their lives. From within these stories, students also provided cues about how they constructed themselves within and across contexts, how they saw themselves being constructed by others, and—more implicitly—how they were constructing themselves in the moment through the process of narrating. From these accounts, which were already coded for references to identity-related factors, I developed summaries of how the focus students described their upbringing and background, ideas about themselves academically and as mathematics students in particular, and narrations about themselves organized according to the identity-related factors they invoked.

I then reviewed each individual student's patterns of identification with discourse, in relation to the identity-related factors invoked as particularly salient in their narrative summaries. These patterns of identification were analyzed according to the specific *discursive roles* students described

for themselves in workshop activities.¹ Emerging from these analyses was what I refer to as a *portrayal of identification* for each focus student, which maps their identification with discourse according to the conceptual model of the study. In this mapping, the interconnections among identification modes, classroom level roles, and a broader set of identity related factors are described as explaining why focus students identified with discourse as they did. Finally, I generated a comparative description of identification portrayals across all three focus students to explain common trends and notable differences in their patterns of discourse.

Toward an Emergent Theory

The explanatory case-study design of this study called for starting with an explanatory model, with subsequent iterations moving toward an emergent theory (Yin, 2003). While the model presented in Chapter III was informed by my early reads of the data as well as formulations from relevant theoretical frameworks in the literature, it represents only a starting point for analysis. In the analysis itself, I set out to iteratively test the assumptions in the model and examine how well it explains the phenomenon of identification within the context of the ESP workshop. This also required some foreshadowing to occur in this and previous chapters, where key concepts, such as those related to positioning and situational roles in discourse, needed to be introduced because of their subsequent emergence as salient factors in the analysis. As such, I carry the analytical approach described in Chapter III and this chapter through iterations of analysis described in the chapters to follow, introducing emergent findings into the explanatory model as the data and analysis dictate.

¹ The construct of *discursive roles* has not yet been operationalized at this point in the dissertation. The connection between students' temporary positions/roles and their identification with workshop discourse was a key phenomenon that emerged in the classroom-level analysis, and that re-shaped the overall conceptual model of the study. This phenomenon will be described in detail in Chapter VI as part of the emergent explanatory theory of the study.

² This phenomenon was primarily related to intrapersonal-level factors, and will be described in

CHAPTER V. IDENTIFICATION WITH DISCURSIVE OBLIGATIONS

In Chapter III, I described a theoretical model for students' identification with discourse in the workshop. My formal analysis begins by laying some empirical groundwork related to the model, which involves demonstrating its foundational constructs as operationalizable within the case-study context (see Figure 5.1).



Figure 5.1. Areas of analysis described in Chapter V.

First, I show that *discursive norms* were, in fact, collectively constituted by workshop participants, and I articulate the specific understandings students described about what it meant for them to be a successful contributor toward workshop discourse, i.e., the particular expectations they associated with the *discursive obligations* as they understood them in the workshop. Second, I show how students' descriptions of their own *identification* aligned with modes of *affiliation, compliance*, and *resistance* as constituted in the personal identities of Cobb et al.'s (2009) interpretive scheme, with the addition of one further category that emerged from the data, *avoidance*. With the groundwork laid with respect to these foundational constructs, I then describe patterns in the workshop related to students' identification with respect to individual students and with respect to discursive obligations. This analysis is intended to determine whether differences in identification modes are largely associated with individual students, with particular types of discursive activity (in the form of discursive obligations), or some other factors as yet unexplored in the analysis.

Discursive Obligations in the Workshop

As described in Chapter II, the ESP workshop design—both historically and in its local implementation at the university site—is constituted as a collaborative environment within a small, informal setting (e.g., a common study area or a classroom with flexible seating) where: 1) students work on challenging, non-remedial problems that are not homework problems in the corresponding calculus course, 2) students work with peers as a means to share ideas for solutions and to persevere in solving challenging problems, and 3) student-instructor interactions are intended to facilitate student thinking without directly answering students' questions or revealing solutions. Although enactments of this design vary from institution to institution and classroom to classroom, ESP workshops tend to manifest these basic facets with varying degrees of fidelity. As the description of research context depicts (see Chapter IV), the case study classroom represented a recognizable, relatively faithful version of the prototypical workshop design.

As such, these three overarching characteristics provided a starting point for empirically establishing a categorical set of discursive obligations for the workshop. In keeping with the interpretive scheme of Cobb, Gresalfi & Hodge (2009), who draw from Searing (1991), a norm is defined as a "recurrent pattern in joint activity that is regulated by the expectations that the teacher and students have for each other's actions in particular situations" (Cobb, et al., p. 44). In this scheme, a *normative identity* represents the general classroom obligations and mathematical

obligations that need to be fulfilled to be a competent student as defined in the classroom. In Chapter III, I described an adaptation of this that focuses explicitly on *discursive obligations*, for reasons already described within the theoretical framing of the study. I defined discursive obligations as the ways of speaking and communicating mathematically, negotiated by the community and understood by participants as what it means for them to be a successful contributor toward workshop discourse in problem-solving contexts. I operationalized discursive obligations according to the broader categories of common discursive activity in the workshop (e.g., "solving problems in small groups"), and include in those obligations students' more specific, commonly described understandings of the expectations they need to fulfill to be a competent communicator in that type of activity. Using the analytical methods described in Chapter IV, I established from the observation and interview data the list of discursive obligations shown in Table 5.1. These discursive obligations were ultimately included because they emerged in both the observation data and interview data, and because participants' reflections coalesced into these coherent, commonly understood categories in the workshop. Table 5.1 also includes a list of associated discursive expectations that provide detailed sense of what students specifically described being obligated to for each broad category. Like the obligations themselves, these expectations were empirically established from a coding process of both interview and observation data, and therefore represent a collective view of student participants and researcher. In triangulating the observation data to the interview data, I weighted students' reflections in interviews more heavily than researcher observations to privilege the students' perspective in the analysis. The rationale was that the conceptualization of normative identity and obligations incorporates participants' collective understanding of classroom obligations, not solely their observed patterns of behavior. That is, students may be observed to act in certain ways but not view their actions as fulfilling obligations with respect to the classroom community.

Observation alone cannot provide sufficient evidence of the distinction. Discursive obligations emerged from analysis of patterns of multiple students describing what they do, or what they ought to do, in the workshop with respect to communication. Conversely, if participants described actions or behaviors that were seldom or never found in the observation data (this was seldom the case), or that were not shared by other students as well, this was not included as a discursive obligation or associated expectation.

Discursive Obligation	Associated Expectations
D1. Solving problems collaboratively in small groups	 Making verbal contributions related to problem solutions Comparing, verifying, revising solutions among group members Asking and answering questions of group members
D2. Sharing solutions with the whole group (participant at the board)	 Writing fully or partially completed solutions to problems on the board Explaining procedures used to solve a problem Answering procedural and conceptual questions asked about solutions by peers and instructor Responding to corrections or suggestions of alternative solutions
D3. Discussing solutions with the whole group (participant at seat)	 Answering questions asked of the whole class by instructor Comparing, verifying, correcting solutions presented at the board by other students Paying attention to the discussion
D4. Interacting with instructor	 Answering questions asked by the instructor Explaining solution strategies and reasoning to the instructor Asking questions of the instructor
D5. Interacting socially (non- mathematically)	 Engaging in discussion about non-mathematics-related topics with peers Sharing humor Discussing broader academic issues and experiences, including those related to the Calculus I course Making an effort to get to know workshop participants

Table 5.1. Discursive Obligations in the ESP Workshop

As an example, for the obligation of solving problems collaboratively in small groups (D1), the more detailed, associated expectations of making verbal contributions, comparing solutions, and asking and answering questions were invoked and described consistently by most participants during interviews, and were also observed consistently during the course of videotaped lessons. These activities were therefore included in what constitutes obligation D1. As an example, as Marco reflects on an instance of small group work, he describes the following:

Marco: like when we talk things through in groups, I notice that we make- like if you notice that something's not right with what you said, they help you realize it... and then try to fix it. like, um- I like to work things out orally that way, yeah. ((nods and smiles))

In this excerpt, Marco identifies group work as the categorical context of discursive obligation. He then goes on to describe more specific expectations associated with the broad discursive obligation D1, such as making verbal contributions related to problem solutions, and comparing, verifying, revising solutions among group members. Marco's use of "we" and the generic form of "you" seems to imply a sense that these expectations are established collectively and applicable to himself.

In a contrasting example, Justin described in his interviews a consistently passive approach in small group work.

Justin: I think it's also more of how I learn, just like visually learning it. I mean, other people are better hands-on learning, like doing the problems themselves. I prefer just to see other people do it. look at examples, and follow it from there, instead of doing it myself.

Although Justin's description was directly associated with an instance of small group work, the actions he associated with small group work were not included with obligation D1 for two reasons. First, there was inconsistency between Justin's description of "taking in what other students do" and observations of his behavior in which he most often appeared not to be following along with conversations (i.e., not looking at other students' papers as they talked, often looking at his cell phone, etc.). Second, this was not an obligation that was invoked by other students with any consistency. While other students did often describe listening as part of obligation D1, they typically described listening as associated with moving forward on a problem solution, rather than as a broad approach to engaging in the workshop as Justin's use of "taking it in" implied. In this way, Justin's description not only was left out of obligation D1, but also constituted a form of participation that ran counter to the classroom construction of obligation D1, which according to the analysis I will describe in the next section, represented a particular *mode of identification* with that obligation.

Modes of Identification

As students reflected on their participation in the workshop, both in relation to specific instances reviewed in video segments and in their general recall of workshop activities, their descriptions reflected distinct *modes of identification* with particular discursive norms. Recalling that identification represents not only the degree to which students take up or reject the normative obligations in the classroom, but also to whom students are obligated (Holland et al., 1998; Hicks, 1996; Linehan & McCarthy, 2000), I viewed identification both in terms of how students described taking up the obligation and to whom students were obligated. Cobb et al. (2009) foreground this idea in describing their analysis of personal identity as a means to document "whether and why [students] are developing an affiliation with, merely complying, or resisting engaging in classroom activities" (p. 63). In my analysis of identification, close attention was paid to students' linguistic cues that distinguished obligations to self from obligations to others. The distinction is a focal point of the study because it represents a traceable marker of one's affiliation with the norms and practices of a classroom community.

In keeping with Cobb et al.'s interpretive scheme, students' descriptions of their identification were initially coded into categories of *affiliation*, *compliance*, or *resistance*, based on linguistic cues I established for each category. I added one additional category, *avoidance*, to capture a set of codes that emerged as separate from compliance or resistance (Table 5.2).

Mode	Description	Examples of Linguistic Cues
Affiliation	Fulfillment of obligation indicated; described as an obligation to self; positive inclination toward fulfillment	 I was trying to I felt confident when I I wanted to I like to I was engaged in I worked harder at
Compliance	Fulfillment of obligation indicated; described as an obligation to others; indication of ambivalence	 You, but you don't care I have to try to I need to prove to others that
Avoidance	Fulfillment of obligation not indicated; description of avoidance or minimizing opportunities for fulfillment of obligation	 I was hesitant to I sometimes don't I reached out a little, then pulled back
Resistance	Fulfillment of obligation not indicated; oppositional response to obligation	 I sit back, I don't care I should, but I don't I never wanted to

<i>Table</i> 5.2.	Modes	of Identification
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Codings were then revised according to a more detailed analysis of the participants' descriptions. I refer to these categories as *modes* to portray a particular focus on identification as a situational phenomenon within the context of this study—that is, as a phenomenon that varied in relation to the specific contexts, tasks, co-participants, and roles associated with each micro-level instance of discourse. The four modes of identification are described in some detail in Table 5.2, which also includes examples of linguistic cues that would indicate each mode.

The first-tier distinction among these modes was whether or not students described an effort to fulfill a discursive obligation. Indications of such an effort operationalize the categorical difference between the affiliation/compliance modes and the avoidance/resistance modes. For example, in describing her participation in small group work (D1), Whitney emphasized the effort she put into making contributions.

Whitney: That's why sometimes I try to prove to, like, others that I can do it. Like maybe that's why I'm so- like I was trying to with Marco? Trying to prove I know this.

Whitney's repeated use of the word "try" implied that she was attempting to fulfill an obligation in small-group discourse, particularly with respect to making verbal contributions. Conversely, modes of avoidance and resistance were associated with a described lack of effort toward an obligation, as in this example when Justin was in a position to fulfill the obligation of going to the board to show a problem solution (D2).

Justin: I was more reluctant, so I didn't go [to the board], just because, like, I don't have the full grasp on it yet. And that just leads me to like, not want to do things in class. It makes me want to stay in the group and see where everything goes.

Justin's description included an account of non-fulfillment as he described not taking up the obligation despite an explicit opportunity to do so.

Justin's account also illustrated a key distinction between the avoidance and resistance modes. Because he described a passive minimizing of an opportunity to fulfill an obligation (e.g., "I was more reluctant"), but did not act in direct opposition, the mode of avoidance was indicated rather than resistance. Justin reinforced this passive stance in a separate passage by saying that he would go to the board if asked directly by the instructor, but that he would prefer not to. Resistance, on the other hand, was indicated by a more active oppositional stance. Ajay, for example, demonstrated resistance in his opposition to participation in small group work (D1) as illustrated in this example: Ajay: I like to keep things to myself, so I don't really open up as much... if something like- someone either like, you know, gets me mad or something like that.

Ajay's reflection suggested resistance in the intentionality of his non-fulfillment of making verbal contributions. There was an explicitly stated decision not to open up in response to another group member's behavior, delivered from an active, resistive stance. Further, this stance did not appear to be negotiable on Ajay's part.

A third key distinction among modes of identification involved whether obligations were described as obligations to self or obligations to others. This distinction marked the key delineation between compliance and affiliation modes. Although in both modes there was a moral sense of "oughtness" toward the norms as they are constituted by the classroom community, in the compliance mode, obligations were fulfilled as obligations to others in the classroom—namely to the instructor and/or other students. In the affiliation mode, obligations were fulfilled as obligations to self. The distinction was exemplified in the contrast between two of Griffin's reflections. In this first passage, Griffin described his participation in whole-class discussion (D3) as an obligation to the instructor and the whole class, rather than to himself.

Griffin: Yeah, you're part of the class, so you should help the class to go along... Like sometimes a teacher would ask a question and we'll linger. Even though everybody knows the answer maybe, nobody answers and we're just staring at the [instructor] for a whole minute. And I'm like, if I know the answer, why not just say it? (I2: 161)

As Griffin explained his rationale for making verbal contributions in whole-class discussion, his generalization that "you should help the class..." indicated—at least on the surface—that his contributions were intended to fulfill an obligation to others in the classroom community, perhaps the instructor in particular, in order to allow the discussion to flow the way it ought to. In addition, his reference to the class "just staring at the prof for a whole minute" implied his sense of collective

discomfort, which he intended to alleviate by making contributions. A notable issue here is that Griffin's account suggested he did not believe the rest of the class shared the same sense of obligation about contributing to whole-class discussion that he did, at least in this instance. In other words, from Griffin's perspective, Obligation D3 was not being fulfilled by the community, which in part motivated his own actions to fulfill the obligation. Thus, compliance was indicated in Griffin's sense of duty to the class to fulfill an obligation that no one else would.

The previous example of compliance can be contrasted with another passage demonstrating Griffin's affiliation with a particular small-group activity (D1).

Griffin: I was working with Whitney's group... I noticed they actually worked out the problems so I just started staying with them more often. Because that's all helping me too. Because we're actually doing the problems and kind of talking about it.

Here, Griffin's explicit reference to the fact that working with this particular group is "helping me too" indicates that he interprets his fulfillment of obligations related to small-group work as something he does unto himself and recognizes as a personal investment, rather than as something he does as an act of compliance to satisfy external expectations. In delineating these modes, I acknowledge the phenomenological challenge of distinguishing obligations to others from obligations to self. It can be argued that the distinction blurs when a moral sense of compassion or altruism is considered, in which case obligations to others may be interpreted as obligations to self. This latter example was such a case, where Griffin's sense of duty may have been as much an obligation to himself—to his own moral code or sense of leadership—as it was to the classroom community. I generally categorized such instances as compliance if there was no explicit indication of self in the description. That is, unless the student explicitly described a personal benefit, a feeling of altruism or accomplishment, or an implication of fulfilling some moral obligation, the instance would be coded as compliance rather than affiliation.

Patterns of Identification Across Participants

It is notable in Griffin's excerpts above that the same participant described two different identification modes in separate instances of discourse. This is perhaps not surprising in itself, where variations in identification for a single participant would be expected to coincide with differences in activities, contexts, and the passage of time. But the variation suggests important related questions: 1) How much variation, and how much consistency, existed in each participant's self-narrated accounts of their identification with discursive norms, and 2) Did all participants demonstrate a similar level of variation, or did the variation itself vary from participant to participant?

To analyze patterns within and across participants, I coded instances of identification for each participant. An *identification instance* is a passage of transcribed text that indicates—by inclusion of associated linguistic cues and by interpretation of the researcher as described in earlier sections—a categorizable identification mode of either affiliation, compliance, avoidance, or resistance. Each instance was bounded within a participant's single, continuous *narrating event* (a self-contained event of recollection occurring in an interview) (Wortham, 2015) related to a particular classroom obligation. Most often, identification instances were connected to a participant's single, *narrated event* (a self-contained, recounted episode—that which is described within a narrating event) prompted by a videotaped excerpt. Less frequently, instances were connected to a narrated event not seen by the participant in a videotaped excerpt but recalled entirely from memory. Also less frequently, instances were recollections of generalized patterns not associated with any specific narrated event, as for example, if a student shared that he or she "usually never spoke up when working in small groups." The numbers of instances coded for each identification mode for each participant are shown in Table 5.3. The numbers in Table 5.3 reflect only how many times an identification instance was coded as a particular stage, but not the relative importance a participant might have attached to his or her description of that identification. For example, a participant's off-handed reference to affiliation in one instance would be counted the same as a detailed, impassioned account of resistance in another instance. Analysis of the counts of the number of coded instances in this and subsequent sections, therefore, should not be interpreted as a quantitative measure of these constructs, which are qualitative in nature. Rather, these counts provide a coarse, browsable indexing of the qualitative data to highlight patterns related to identification, which I then explore qualitatively in subsequent analyses. As a general pattern within the workshop, affiliation was the most frequently coded mode across participants, and by a wide margin.

Participant	Recalled Instances at Each Stage of Identification			
	Affiliation	Compliance	Avoidance	Resistance
Marco	33	0	0	1
Sam	17	1	0	0
Griffin	20	5	5	3
Kaytlin	16	0	5	5
Whitney	18	7	9	1
Ajay	9	2	5	2
Vik	7	2	8	0
Justin	1	2	5	0
Total	121	19	37	12

Table 5.3. Identification Instances by Participant

Of particular interest in the study was the key distinction between affiliation and the other three "non-affiliative" modes, which delineated norms being carried out as obligations-to-self (i.e.,

affiliation) versus as obligations-to-others (i.e., compliance if fulfilled, or avoidance/resistance if not fulfilled). I therefore combined the counts of instances of compliance, avoidance, and resistance into

a single category of "non-affiliation" in Table 5.4 to provide a basis of comparison between affiliative and non-affiliative modes.

The sizeable range in the total number of coded instances across the eight participants indicated in Table 5.4 is noteworthy, ranging from 35 (Whitney) to 8 (Justin). Bearing in mind that these counts were derived from interview data, the total number of coded instances for any one participant is interpretable as the number of narrated instances reflecting one of the modes of identification during the interviews, not as a measure of how consistently the student participated in discursive activities in the classroom. Higher counts may indeed coincide with higher levels of participation in discourse, but they will also be closely related to a participant's inclination and disposition toward verbal reflection during the interviews. Thus, Whitney's relatively high number of coded

Participant	Recalled Instances, Affiliation vs. Non-affiliation			
	Affiliation count	Affiliation % of total	Non- affiliation count	Non- affiliation % of total
Marco	33	97%	1	3%
Sam	17	94%	1	6%
Griffin	20	61%	13	39%
Kaytlin	16	61%	10	39%
Whitney	18	51%	17	49%
Ajay	9	50%	9	50%
Vik	7	41%	10	59%
Justin	1	13%	7	87%
Total	121	64%	68	36%

Table 5.4 Identification Instances by Participant Condensed

instances indicates that she was inclined to explicitly describe and portray her discourse in the workshop, and that her participation afforded numerous opportunities to do so. Conversely, Justin was likely less inclined to make such descriptive portrayals of discursive instances, and he participated in a way that afforded fewer opportunities to do so.

Differences in frequency of affiliation among participants are evident in Table 5.4. Two students, Sam and Marco, I characterize as "highly affiliative" based on the relative predominance of their coded instances being categorized as affiliation (97% and 94% of the total number of instances, respectively). One student, Justin, I characterize as "non-affiliative", with 13% of instances being coded as affiliation. Five students (Griffin, Kaytlin, Whitney, Vik, and Ajay) I characterize as "mixed affiliative/non-affiliative," with the relative frequency of their coded instances of affiliation ranging between 61% and 41%. These percentages reflect that, while these students frequently affiliated with discursive activity, a substantial portion of instances were also coded as compliance, avoidance, or resistance (i.e., non-affiliation modes). For these five students there was substantial variation in their identification from one instance to the next. This subgroup provides a compelling context for investigating possible sources of variation across instances for individual students, in ways that are not possible for the consistently affiliative and non-affiliative students.

Thus overall, the eight participants identified with discursive norms in the same classroom in substantially different ways that reflected broad variations in their distribution of affiliative and non-affiliative modes of identification. In subsequent chapters, I will describe further qualitative analyses and results with the intention of explaining why these individual variations emerged.

Patterns of Identification Across Discursive Obligations

In addition to investigating variations among individual students, I also looked for variations related to the discursive obligations themselves. Table 5.5 shows the number of instances coded for each mode of identification, subdivided according to the 5 discursive obligations established in the workshop. The total number of instances varied substantially across the five discursive norms, ranging from a total of 117 instances coded for collaborative group work (D1) to just 5 total

instances coded for social interaction (D5). This variation is primarily a coarse indication of the relative time students were engaged with each obligation. In general, students' reflections from phase-2 interviews (the primary source of coded instances) were related to the video segments shown during the interview. These segments were selected to roughly represent the amount of time and emphasis these obligations received over the course of the semester. As an example, collaborative problem-solving in small groups (D1) was the most commonly cited obligation throughout the semester. I therefore selected a corresponding proportion of video segments of small-group work as video prompts during the phase-2 interview. As such, it was not unexpected that there were more recalled observations related to this obligation than any other. Conversely, one-on-one interactions with the instructor (D4) were observed far less frequently, and were therefore shown less frequently as video prompts during the phase-2 interview, which would account—at least in part—for the lower frequency of codes for D4.

Tuble 5.5.	Tueniijicuiioi	n Instances Acr	OSS DISCUISIV	e Obligations	
Discursive Obligation	Affiliation	Compliance	Avoidance	Resistance	Total
D1. Solving problems collaboratively in small groups	71	11	25	10	117
D2. Sharing solutions with the whole group (participant at the board)	30	3	5	1	39
D3. Discussing solutions with the whole group (participant at seat)	11	4	1	1	17
D4. Interacting with instructor	6	1	4	0	11
D5. Interacting socially (non-mathematically) with peers	4	0	1	0	5
Total	122	19	36	12	189

Table 5.5. Identification Instances Across Discursive Obligations

As Table 5.5 also shows, there was little disparity in how "relatively affiliative" one discursive obligation was compared to the next, particularly among the four most-frequently coded obligations. This result is further clarified in Table 5.6 by condensing compliance, avoidance, and resistance into "non-affiliation," as was done in Table 5.4.

For group work (D1), 61% of instances were coded as affiliation. For participants sharing solutions with the whole group (D2), whole-group discussion (D3), and interacting with the instructor (D4), 76%, 65%, and 80% respectively were coded as affiliation. Keeping in mind that these are not to be taken as quantitative measures, I interpret these relative frequencies as suggesting that across all obligations, students generally tended toward affiliation over non-affiliation. In addition, students did not categorically describe affiliating, or not affiliating, with any obligations over any others. That is, at least in terms of coded instances, no norms appeared to be notably preferred or shunned by comparison.

Obligation	Recalled Ins	stances, Amina	ition vs. Non-a	iffiliation
	Affiliation count	Affiliation % of total	Non- affiliation count	Non- affiliation % of total
D1. Solving problems collaboratively in small groups	71	61%	46	39%
D2. Sharing solutions with the whole group (participant at the board)	30	76%	9	24%
D3. Discussing solutions with the whole group (participant at seat)	11	65%	6	35%
D4. Interacting with instructor	6	55%	5	45%
D5. Interacting socially (non- mathematically) with peers	4	80%	1	20%
Total	122	65%	67	35%

 Table 5.6. Identification Instances Across Discursive Norms, Condensed

 Obligation
 Bogollad Instances Affiliation vg. Non officiation

The fact that students identified with each obligation across a range of modes, rather than in any single, predominant mode suggests that identification is not a simple function of the type of discursive activity in which students are engaged. Although group work, presentations of board work, whole-class discussion, and student-instructor interactions are affiliated with more often than not, this is not always so. In fact, it is often not the case, and it is often not the case for *each* of these types of activities. The implication is that the ways students identify with discursive norms is connected to something beyond the nature of the obligations themselves as they are constituted in the classroom community. The variations within obligations suggests that there are individual differences in the ways students negotiate and make meaning of their identification, and that there are situational differences that come into play as students encounter opportunities to fulfill particular discursive obligations. In the next chapter, I explore further patterns related to these individual and situational differences. Using the lenses of positioning theory and a multi-level framing of identity, the analysis turns to an investigation of why these differences play out in the ways they do in the case study workshop.

Summary

The workshop as a community has constituted a set of discursive obligations that appear to be interpreted with relative consistency across participants. Students' descriptions of discourse in the workshop fall into broad categories of obligations related to small group work, presenting solutions to the whole class, discussing others' solutions with the whole class, interacting with the instructor, and interacting socially. At one level, these obligations might simply be interpreted as the normative activities in the workshop that involve communication—the "talk activities" that, perhaps as a matter of workshop design, the instructor asked students to engage with, which have consequently become part of the workshop routine. Taken this way, they could just as easily have been established through observational means alone. In terms of the broader analytical model, however, these obligations take on their salience when viewed in terms of the more specific expectations students associate with them. That is, what do the students believe they are obligated to in each type of discursive activity? Examples of these particulars appear in the right-hand column of Table 5.1, but are further nuanced in students' descriptions of their modes of identification.

Students in the workshop also indicate the theorized modes of identification (plus one additional) in their reflections about discourse, which represents a noteworthy finding in itself: that identification is interpretable in students' descriptions of micro-level instances of discourse. These modes were defined and refined through discourse analysis conducted on students' phase-1 and phase-2 interviews. Although some established linguistic cues were helpful aids in classifying these modes, I recognize that their coding at times requires levels of interpretation than introduces some uncertainty, though I believe there is enough clarity that related findings are defensible.

Finally, this analysis shows several patterns related to identification. First, students in the workshop can be categorized as: highly affiliative, non-affiliative, and mixed affiliative with respect to workshop discourse. Second, particular modes of identification did not group toward any particular discursive obligations, suggesting that identification is not a simple function of the type of discursive activity in which students are engaged. Both of these findings motivate further analysis to explain why students might consistently affiliate or not affiliate with discourse, and in the cases of mixed affiliation, what situational differences might account for variations if they are not explainable in terms of obligations themselves.

CHAPTER VI. IDENTITY-RELATED FACTORS

Having established the discursive obligations and modes of identification from students' descriptions of discourse, the analysis moved toward examining *why* students identified with discursive instances as they did, based on the identity-related factors they invoked (see Figure 6.1). I begin this chapter with a brief description of how students' accounts revealed a broad spectrum of factors invoked by workshop students collectively from the full range of levels (i.e., sociocategorical, community, academic/disciplinary, school, workshop, and intrapersonal). An emergent finding in these data, however, suggested the primacy of classroom-level *positioning* in discourse as an eminently salient identity-related factor raised in students' explanations of their modes of identification. This prominence of positioning motivated a deeper exploration into how the temporary, situational roles students described for themselves in discursive instances



Figure 6.1. Area of analysis described in Chapter VI.

influenced their identification with those instances. These micro-level roles were analyzed categorically (e.g., as related to competence, collaboration, friendship, etc.) and according to the relative status and relational typology they represented to uncover patterns between roles and identification. Findings related to this analysis called for further revision to the theoretical model, and set the table for a final set of subcase analyses probing one level deeper into the intersections between identity-related factors and situational roles in discourse.

Identity-Related Factors

Iterative coding and analysis of students' accounts from interview phases 1 and 2 revealed a categorical taxonomy for factors invoked by students in describing their participation in workshop discourse. The seven categories are defined below, and Table 6.1 indicates specific examples of factors associated with each of the 7 broad categories, as well as the corresponding level for each in Martin's (2000) multilevel framework.

1. *Sociocategorical* factors were implicated when participants referenced identities related to categories broadly assigned to or negotiated (asserted) by, such as race, gender, economic status, in describing their identification with discursive activity, as for example, when students describe their identification with a discursive activity in connection with racialized or genderized experiences.

2. *External community* factors refer to a student's membership and participation in communities of practice outside of their university academic communities, which the participant narrated in connection to discourse in the workshop. These include communities related to family, workplace, social organizations, neighborhood, etc.

3. *Disciplinary* and *academic identities* factors indicate a connection to the student's academic experiences and understandings about themselves related to academic communities outside of the

ESP workshop. These include the Calculus I lecture and discussion session associated with the ESP workshop, previous classroom experiences both in mathematics and other disciplines, and other academic experiences at the university outside of the calculus course.

4. *Classroom-level disciplinary content* includes all specific references to mathematical understandings, content, and problems associated with the ESP workshop.

5. *Classroom-level conventions* refers to factors involving the structured norms, instructional approach, and disciplinary content of the ESP classroom.

6. *Classroom-level positioning* includes students' perceptions of how they are positioned in the classroom community related to issues of status, competence, and temporary roles they take up during discursive activities within the classroom community.

7. *Intrapersonal identities* refers to factors that reflect a generalized self-perception that participants narrate about themselves across communities and contexts, as for example, if a student refers to herself as "usually extroverted" as an explanation for why she affiliates with a particular form of discursive activity.

The following set of passages illustrates how these factors and related themes were coded in interview data. In these excerpts, Kaytlin is referring to her participation in a videotaped instance of small-group work (Discursive Obligation D1) she has just viewed as part of the phase-2 interview. In the video clip, she and two other students, Marco and Sam, resolve a disagreement about the value of an antiderivative they are calculating. Kaytlin points out a conceptual error Marco made, mistaking a constant term for an independent variable.

Kaytlin:	I like it when he gets things wrong and I can help him. ((laughs))
	I loved it. I like it when he doesn't know a question. ((laughs)) It makes me feel
	good. I'm like, yes I know something he doesn't ((pumping fist)) because he
	always knows more than me.
TS:	So did knowing more than him this time matter to you?
Kaytlin:	I think so. ((laughs)) I want to do- I mean I want to do my best if that's not the

best, but I usually- in almost everything I strive to be the best, to be number one. I do, I do, I do. I like it.... I like being number one, especially in that environment. It's in some ways a driver. Yeah. Where do you think that comes from?

TS:

Factor Category	Corresponding Level (Martin, 2000)	Examples of Associated Factors
Social categories		African American identity Latinx identity Gender identity Economic class and income Experiences of race and racism
External communities	Community	Family identity Professional identity Athletic team(s) Peer friendships Job-related identity
Disciplinary and Academic identities	Community/School	Calculus I grades Calculus I course College academics Disciplinary math ID K-12 mathematics K-12 Academics
Classroom-level disciplinary content	School	ESP mathematics content ESP problems
Classroom-level conventions	School	Classroom norms Disciplinary content Course structure Modes of activity
Classroom-level positioning	School	Peer relationships Competence Status & positioning Teacher relationship Participant roles
Intrapersonal identities	Intrapersonal	Competitiveness Self-confidence Extroversion Self-consciousness

Table 6.1. Identity-Related Factors

In response to this latter question, Kaytlin offers several explanations about the source of her felt need to be perceived as "number one." One of her explanations invokes her identity within her family community:

Kaytlin:	I'm the oldest in my family, so my younger sister, she's- she's very competitive. She's in a lot of sports and stuff like that, so I always had to feel like I had to compete with her. So she was good at sports and I was good academically. Like
	that's how it was. I had to be better than her ((laughs))
TS:	Did your parents play any role in that?
Kaytlin:	I think so. When I was younger- See, I have a thing where I don't like to disappoint my parents? And I don't like to get in trouble. ((shakes head)) So I always try and do my best. You know, I'd never yell or get really mad or anything. It was just personally I didn't want to disappoint them, so I always had to be the best and do the best. And when my sister was starting to get good grades too, I was like oh, you- no, I'm the smart one. You're not the smart one.

Taken collectively, these passages suggest three specific, identity-related factor categories. The first is *classroom-level positioning*. In Kaytlin's first turn, she describes her position relative to Marco in terms of helpfulness and competence. In this particular instance of small group work, she sees herself in a temporary role of being able to help Marco past a misconception he has about the nature of the variables in the problem. At the same time, she contextualizes this role as counter to her more consistent position as less competent than Marco by following with, "He always knows more than me."

The second factor is related to Kaytlin's self-described competitiveness as constituted in her striving to "be the best, to be number one" as a self-perception that spans across communities and contexts. This description indicates an *intrapersonal identity* in which Kaytlin attributes an internalized sense of competitiveness to herself in communities and contexts beyond this single instance of working with Marco.

A third factor category, *external communities*, is invoked in Kaytlin's attribution of her competitiveness as being related—at least in part—to her identity within her family. This attribution

is indicated in Kaytlin's specific references to her family and how she constructs herself and is constructed by others in relation to that community. These three factors are coded in this passage because of traceable connections between the factors and discursive obligations in the workshop, in this case, making contributions in small-group work (Discursive Obligation D1). That is, Kaytlin explains her affiliation with this instance of this obligation as related to: 1) her temporary role as "helper" relative to Marco (*classroom-level positioning*), 2) her sense of her own competitiveness (*intrapersonal identity*), and 3) her family identity (*external communities*).

Something to note in this example is the way factors are nested in participants' "explanations of explanations". In this case, Kaytlin's initial explanation for her affiliation includes a reference to her positioning as helper to Marco. Her affiliation is perhaps amplified because of her sense of competitiveness, which enhances her satisfaction at being able to correct Marco's misconception. She then invokes her family identity in her explanation about her competitiveness—her consistent desire to "be the best." This nesting is a common phenomenon found throughout the interview data, related in part to the interview structure designed to evoke layered explanations through a probing series of follow-up "why" questions.

The Primacy of Positioning

To analyze if and how identity-related factors may influence students' identification with classroom discourse, it is useful to determine at a high level and for data-browsing purposes which factors occur most frequently in students' narratives. As with the initial code-count analyses conducted in Chapter V, frequencies of coded instances only provide an indication of how often a factor is invoked across participant interviews, but suggest nothing about the salience of a coded instance—how important the factor may be in the narrated account of the student—or even how long

a coded passage may be. That is, frequencies do not tell the story, but they do suggest which factors were brought up, how often, and by whom. They therefore provide indications of where to look for qualitative patterns in the data. Frequencies of coded instances of each identity-related factor category are shown in Table 6.2.

Factor Category	Coded Instances
Social categories	7
External communities	21
Academic and mathematics identities	71
Classroom-level conventions	57
Classroom-level disciplinary content	16
Classroom-level positioning	192
Intrapersonal identities	31

Table 6.2. Counts of References to Identity-Related Factors

When participants described their participation in classroom discourse, they invoked *classroom-level positioning* as a salient factor in explaining their participation at a frequency nearly equal to all other factors combined, and in nearly every instance of discourse described by students. In addition, classroom-level positioning was consistently the primary factor invoked in nested accounts. That is, students' explanations typically referenced classroom-level positioning initially, with connections then being drawn to other factor categories in follow-up explanations. Finally, classroom-level positioning was the only factor described as salient by all eight participants.

The emergence of positioning as a primary factor in students' descriptions of identification with discourse led to a reformulation of the theoretical model presented in Chapter III. In this new iteration shown in Figure 6.2, classroom-level roles and positions are elevated as a primary factor in the overall conceptual representation, rather than simply as one of many identity-related factors. In this diagram, situational roles are represented as primarily salient in students' descriptions of their modes of identification with discursive obligations. Five categories of situational roles emerged from

data analysis are listed in the associated box in Figure 6.2. These will be described in the following section.



Figure 6.2. Positioning as a primary IRF intersecting with identification modes.

Positioning Analysis

The primacy of classroom level positioning, both in terms of the frequency with which it is invoked by students and its frequent status as a "first-level" factor used to explain students' participation, called for a deeper analysis into *how* students viewed positioning as being influential in their identification with classroom discourse. To conduct this analysis, I draw from Bucholz & Hall's (2005) description of a *positionality principle*, developed by linguistic ethnographers to capture the flexible and nuanced identity relations that occur in local, micro-level contexts. The principle holds that participants in discourse often orient toward local-identity categories rather than broad societal categories in constructing their identities within a particular community; but that these broader categories can and often do intersect with how these local orientations are constructed.

At the most basic level, identity emerges in discourse through the temporary roles and

orientations assumed by participants, such as evaluator, joke teller, or engaged listener. Such interactional positions may seem quite different from identity as conventionally understood; however, these temporary roles, no less than larger sociological and ethnographic identity categories, contribute to the formation of subjectivity and intersubjectivity in discourse. On the one hand, the interactional positions that social actors briefly occupy and then abandon as they respond to the contingencies of unfolding discourse may accumulate ideological associations with both large-scale and local categories of identity. On the other, these ideological associations deterministic fashion (Bucholz & Hall, 2005, p. 591).

Thus, the positionality principle proposes temporary roles and orientations as an analytical starting point for accessing participants' positional identities, from which more lasting and stable identities may accumulate through repeated patterns of positioning both within and across contexts and communities. This approach calls to mind a process referred to by Holland & Lave (2001) as the *thickening* of identity, where a particular role, position, or identity becomes reinforced over time into a more stable, solidified enactment of self.

The particular ways students narrated their temporary roles and positions during episodes of discourse in the ESP workshop were catalogued from the interview data. An *instance of positioning* was defined as a narrated event in which a specific role or position was named, described, or referenced. As positioning is relational by nature, narrated events were categorized as instances of positioning when they indicated roles and orientations described in relation to another participant or participants. For example, in this passage, Griffin narrates an instance of his positioning as taking up the role of help provider with Vik, whose is conversely positioned by Griffin in the complementary role of help receiver.

Griffin:	I remember I started talking to him more ((points to Vik on the screen)). Like I
	was asking him did he understand it? And I was explaining how you solve the
	problem.
TS:	How did that play out?
Griffin:	I think he understood, I think.

Positioning instances were coded from the perspective of the narrator (i.e., the participant being interviewed); thus, in the passage above, the role was coded as "help provider" because Griffin ascribed this role to himself in his narration of the instance. Vik's role of "help receiver" in this instance was not explicitly coded in this scheme because it was assigned to another participant by the narrator. Thus, the unit of analysis in this part of study was the participant being interviewed, privileging that student's perspective on her or his own accounts identification modes, discursive roles, and identity-related factors.

During the 16 interviews, there were a total of 192 recounted instances indicating a temporary, relational position in an enactment of one of the five discursive obligations in the workshop. Using a method of constant comparison, these coded instances of positioning were grouped into six categories: 1) collaboration, 2) relative competence, 3) vocality, 4) friendship, 5) motivation, and 6) contention.

Collaboration was the most-often described positioning category in students' interviews (71 instances). This category included roles related to how students worked together toward the goal of completing the assigned calculus problems. Collaborative roles were described in 71 total instances occurring among all 8 participants. The most frequently invoked collaborative roles included those of help provider and help receiver (14 and 33 instances, respectively). Less frequent roles included facilitator, bystander, mutual collaborator, and verifier/corrector. The structure of the workshop as explicitly communicated by the instructor included an expectation that students work together on solving difficult problems, but left open how students might take up collaborative orientations. As such, the majority of students described collaborative roles that varied situationally among help receiver, help provider, and other less frequently invoked roles across contexts. Two participants

(Vik and Justin), however, consistently and exclusively described themselves in the collaborative role of help receiver. I discuss these phenomena in more detail further on.

Relative competence includes participants' accounts of their own competence in relation to a mathematical or general obligation, relative to the perceived competence of other(s) participating in the same instance of discourse. This category of roles was also frequently described by students (57 total instances). Positions of competence were primarily stable within recalled instances, although at times a participant's description implied a changing position with respect to competence within a recalled instance where the participant narrated a re-negotiation of relative competence (typically toward an increase in relative competence) within the instance. Specifically, competency roles fell into these subcategories based on the relationship to other participants in the discursive instance: less competent (11 instances), equally competent (22 instances), more competent (15 instances), unconcerned with relative competence (4 instances), and renegotiating relative competence (7 instances).

Vocality was defined in terms of a participant's self-ascribed tendency to contribute vocally relative to other participants, invoked in 31 total instances. This category is distinct from collaboration in that it does not imply any particular role related to the solving of workshop problems, but simply indicates the amount of verbal contribution a student ascribes to herself relative to other participants in discourse. The vocality category includes roles of being more vocal, equally vocal, or less vocal than one's counterparts.

The category of *friendship* includes references to positions of interpersonal connection with other participants in workshop discourse (16 total instances). This category includes students' explicit accounts of friendship, non-friendship, and social interactions or feelings of rapport not explicitly

described as friendship. It also includes references to friendship both inside and outside of the context of the ESP workshop,

Motivation refers to comparative descriptions about motivation and engagement compared to others, including references to positions of being more motivated than others to engage in discursive instances, equally motivated to others, or less motivated than others (13 total instances).

A final category, *contention*, refers to positions of contentiousness between a narrator and other participants. This includes references to directly challenging others' ideas, being directly challenged by others, or being judged by others in discursive instances. These positions occurred the least frequently (3 total instances) compared to all others.

Relationship between Identification and Positioning

The prominent influence of temporary roles described above motivated further analysis into *how* these roles may have influenced students' identification modes. This exploration was directed at questions of why students identified with discursive obligations in the ways they did, and of how identity-related factors accounted for individual differences among students. That is, if students described taking up particular roles during specific instances of discourse, how did those roles interact with students' identification modes? This question was addressed by cross-linking identification modes with the temporary roles described in the previous section. An example of this cross-linking occurs in the following passage in which Marco makes ascriptions about his identification with sharing solutions at the board (D2).

l Marco:	yeah, I never reject that- I never reject the opportunity to go up to the board
	and talk about it ((laughs))
2 TS:	so, what's the meaning of that for you, or the motivation for you?
3 Marco:	hmm, it's showing to myself and- well, yeah- I'm showing myself that I know
	this problem, that I have enough courage, or I have enough confidence that I
	can solve this on the board in front of everyone else. and I'm comfortable with

where I am compared to everyone else. It could be like, hey I know how to solve this problem ((mimics writing with chalk on the board)). you can come to me if you guys need help on a problem like this. then I can help you out and I'd be happy to help you out.

In turn 1, Marco indicated affiliation with the discursive obligation of discussing his solution at the board (D2) through his assertion of "never rejecting" an opportunity to fulfill the obligation. In turn 3, two distinct role categories emerged in the narrative: relative competence and collaboration. Marco first described his fulfillment of the obligation as an opportunity to demonstrate his competence with solving this type of problem in front of the class. His description of his comfort level with "where I am compared to everyone else" indicated that he saw himself as equally competent with the rest of the class collectively. Second, through Marco's hypothetical invitation to other students in the class to "come to me if you guys need help on a problem like this," he narrated a collaborative position of help-provider through his explanation at the board, which appears to be directly connected to his affiliation with this obligation. Thus, this passage was cross-referenced as an instance of affiliation with two distinct roles: equally competent and help-provider.

The interview data were analyzed in this way for all 8 participants, resulting in a set of 191 total narrative instances from the interview data that included both a code for identification with a particular discursive obligation and a code for the role being narrated in the instance. The specific goal of this code linking was to discover emergent patterns between forms of identification and particular positions taken up in discourse.

Three notable patterns emerged from this analysis on a broad level. First, the role category of *contention* was exclusively associated with non-affiliative modes of identification. It is important to recall that positions of contention were the least often referenced by participants, arising in only three instances involving a total of two participants, Ajay and Justin, across all interviews. This result in itself corroborates that "contentious argumentation" was not included in the collectively

negotiated set of discursive obligations (see Chapter V). Rather, conflicting contributions in the classroom were typically taken up and resolved by participants operating from less oppositional stances (e.g., verifying solutions, giving and getting help). Recalling that contention refers to positional relationships of challenger/defender or judger/being judged between a narrator and other participants, it is noteworthy (though perhaps not surprising) that students' accounts of these instances did not reflect affiliation. This example narrated by Ajay, in which he challenges a point made by the instructor about a practical application associated with an optimization problem being discussed by the whole class (Discursive Obligation D3), illustrates an instance of contentious positioning connected to an avoidance mode of identification.

175 Ajay:	um, but what I did notice was, is that I was kind of arguing with [the
	instructor] about machines and the way they make cans. but then I also saw
	myself being a little uneasy on some of the things that he did say, only
	because at the time, he was like- at the time when he said that computers are
	kind of stupid, they only tell you what you want it to do? I could have had a
	complete- had a completely better kind of argument for that, but I was just- I
	didn't really want to go into that because that would be just a waste of time
178 TS:	so the statement that computers are dumb and only do what people tell them to
	do to you is kind of like, [you thought] there was a counter-argument to make
	with the whole AI aspect of computing?
179 Ajay:	yeah, like that whole aspect- I wasn't going to go into that, only because it
5.5	wasn't really necessary for the class, but yeah.

Ajay's account is important for reasons beyond exemplifying an instance of avoidance related to contentious positioning. In this instance, it appears that Ajay's understandings of the discursive obligations of the workshop have influenced his avoidance of furthering this discussion thread. In stating that continuing the argument "wasn't really necessary for the class," (turn 179), Ajay privileges established discursive norms related to mathematical discussion of calculus problems over what he considers more tangential concerns about a real-life context. Ajay does not claim avoidance of the role of challenger because of a personal aversion to argumentation per se, but because in this case he sees it as unproductive toward the broader mathematical goals of the class. He therefore

abandons his challenge and avoids further engagement in the discussion even as the instructor is willing continue with it.

A second notable pattern that emerged from the cross-analysis of identification and positioning categories was that the positioning category of *friendship* was generally connected to affiliation. In all but two out of a total of 19 recounted instances where friendship-related roles were invoked, students described affiliation with discourse. This pattern is notable in that the friendship category included a substantial number of coded instances in which a student explicitly stated that a friendship did *not* exist with another participant outside of the classroom. The code category included a range of descriptions related to favorable, unfavorable, or neutral interpersonal relationships with other participants within the context of the classroom where friendship was not explicitly invoked. In general, explicit mentions of friendship with another participant were typically connected to affiliation with a discursive instance. Further, the absence of friendship did not seem to influence identification one way or another, as illustrated in Kaytlin's account of working in a small group with Marco and Sam.

274	Kaytlin:	but it's like this one ((points to the computer screen showing still video frame
		of Kaytlin, Marco, and Sam), it's like I don't know any of them.
275	TS:	I was going to ask you about that. do you feel like you have any friendships in
		this class? even if they're self-contained within the walls of the classroom,
		would you say that?
276	Kaytlin:	I mean I guess like with MARCO or- I keep forgetting his name, it starts with
		an S ((tapping her nose, squinting))
277	TS:	uh, Sam.
278 H	Kaytlin:	Sam. yeah, I think that's why I can't remember it. yeah, we usually work in our
	-	group together, and I respect both of their- you know and I think they both, to
		some extent, respect what I say. but I know that's not like real strong, you
		know, friendship thing. it's kind of like, hey I know you're smart so let's
		collaborate, kind of thing. ((laughs))

Kaytlin's account here is remarkable in that, despite having worked with these two students on a consistent basis for approximately half of the semester to date, she does not consider either of them
to be friends, and in fact she still does not know the name of one of the students. This passage illustrates that Kaytlin does not view her role in this small group in terms of friendship, but rather sees her positioning playing out in relation to relative competence and mutual collaboration. Although Kaytlin narrates a somewhat extreme version of this construction of the classroom community, it is representative of the ways the broader group of students privilege competence and collaboration over interpersonal friendships in their accounts about classroom discourse. One exception, however, occurs in Ajay's narration about developing social connections in the workshop.

- 292 Ajay: uh, I'm saying they need to be willing to take a couple minutes out of that time to talk and like, just to chill and stuff...
- 297 TS: so if you feel like you've made some kind of connection that's just not about the math, that you feel like you'll be much more likely to have a good math conversation?
- 298 Ajay: well, yeah, kind of. sometimes if I don't know the person I'll just do [the problem] myself first, before either the teacher will come over and they'll start asking for help? only because, like I said, it's because I don't know the person as well? so, I tend to be more reserved- I would say more reserved, more to myself. before I start to try to open up and everything.

For Ajay, it is important to "know the person" at some level as a prerequisite to collaborating with another person on workshop tasks. In turn 298, Ajay indicates a mode of avoidance with discourse until he is able to establish some level of interpersonal friendship with other participants. In a separate instance, Griffin invokes a lack of a friendship in describing avoidance with discourse. As salient as these connections are to Ajay and Griffin in these accounts, they represent an exception to the more common pattern, where friendship is generally described as connected to affiliation, but a lack of friendship is generally not connected to students' modes of identification.

The third notable pattern was that students did not affiliate with any positioning category (other than contention and friendship) substantially more or less than any of the other positioning category. That is, all positioning categories other than friendship were identified with in both affiliative and non-affiliative ways, in relatively equal measures.

Research on positioning suggests that the way students position themselves, or are positioned by others, is meaningful to identity construction in that it promotes the assignment of relational power and status among participants. The six positioning categories identified in my initial coding scheme (relative competence, collaboration, vocality, friendship, motivation, contention) were characterized by the *subject* of a given instance of positioning, not by the issues of relative power and status that might arise in a given instance. It therefore might not be expected to find any further patterns without taking into account how issues of status and power figure into the analysis of positions and roles in students' identification with discourse. In the following section I discuss the results of this analysis.

Positioning, Relative Status, and Identification

Presuming that the power and status associated with particular positions would be influential to students' identification with discourse, I analyzed identification according to the set of sub-codes within each positioning category, which delineated specific positions and roles in more detail, and provided indications of the relative status associated with positioning instances. These subcodes are shown in Table 6.3. I then developed a relational typology (cf. Bishop, 2011) for the subcodes to further describe the type of relative positioning scenario each subcode represents. Using a constant comparative approach, I found that the subcodes coalesced into three distinct groupings, or *role types*: 1) *equipositional*, 2) *authoritative*, and 3) *unilateral*. Assignments of positioning subcodes to role types are also indicated in Table 6.3.

I use the term *equipositional* to describe role types in which there is little or no associated difference in status. where equal relative status among participants in a discursive instance, as indicated in the rightmost column of Table 6.3. Equal relative status is implied when participants

describe roles that are similar to that of their counterparts in discourse. Roles of equal competence and mutual collaboration, for example, represent clear cases of equal status where describe positions . with the following passage showing how these two positions reflect equipositionality within the context of Griffin and Whitney were working together on a problem solution (Discursive Obligation D1).

Positioning Category (Positioning Codes)	Associated Roles (Positioning Subcodes)	Role Type	Relative Status
Relative competence	More competent	Unilateral	Higher
	Equally competent	Equipositional	Equal
	Less competent/lacking competence	Unilateral	Lower
	Re-negotiating relative competence	Equipositional	Equal
	Unconcerned with relative competence	Equipositional	Equal
Collaboration	Help provider	Authoritative	Higher
	Help receiver	Authoritative	Lower
	Verifier/corrector	Authoritative	Higher
	Facilitator	Authoritative	Higher
	Mutual collaborator	Equipositional	Equal
	Bystander/non-contributor	Unilateral	Lower
Vocality	More vocal	Unilateral	Higher
	Equally vocal	Equipositional	Equal
	Less vocal	Unilateral	Lower
	Mutually non-vocal	Equipositional	Equal
Friendship	Friend	Equipositional	Equal
	Non-friend	Equipositional	Equal
	Co-socializer (instance specific)	Equipositional	Equal
	Developing a connection with	Equipositional	Equal
Motivation	More motivated	Unilateral	Higher
	Equally motivated	Equipositional	Equal
	Less motivated	Unilateral	Lower
Contention	Challenger	Authoritative	Equal
	Being judged by	Unilateral	Lower

Table 6.3. Positioning Categories, Associated Roles, and Role Types

33 Griffin:	I think I was just kind of checking both of our answers. I think she thinks she got the right answer, and I was trying to see how mine was- like trying to just compare them
24 TS.	akay sa yay wara kind of looking alangsida Whitney?
54 15.	okay, so you were kind of looking alongside winney?
35 Griffin:	yeah.
36 TS:	and then talking through it a little bit?
37 Griffin:	because we probably had different answers but- and we were trying to see where we kind of- and we were going step by step to see when we started to
	do it different. Like when we started getting different answers. at what part of

the problem did we kind of split and do different things? like, do you know what I'm saying? everybody starts it the same way, and then somewhere someone goes wrong in the middle of it-

A detailed inspection of the passage attests to the equal status being narrated by Griffin. In turn 1, Griffin narrates that Whitney thinks her solution is the correct one, but he contests her assumption in his own recalling of the event: "I was... trying to just compare them". Griffin's repeated use of the word "differently" in turn 5 indicates that for him it is still an open question as to who has solved the problem correctly, and that their interaction is a mutual process of verification and error detection, accomplished from a position of equal competence.

It is important to note, however, that equipositional roles do not exclusively imply positive or mathematically productive roles. A shared position of "mutually non-vocal," for example, arises in a several students' recounted instances and is generally associated with a tacit agreement of non-engagement among participants. Although it tends to be a non-productive position with respect to the discursive obligations in the classroom, it is reached from a position of equal status.

Unilateral positions are those marked by descriptions of differential status in a discursive instance, narrated by the participant as a one-sided affair with the higher-status participant(s) initiating, maintaining, and/or controlling the discourse, and the lower-status participant(s) tending to acquiesce or else disengage from discourse. Higher-status unilateral positions include those of being more competent, more vocal, or more motivated relative to other participants. Lower status unilateral positions involve descriptions of "less than" (less competent, vocal, or motivated) relative to others, as well as being a passive bystander or being judged by others. In unilateral instances, the narrator may occupy either the position of higher status or of lower status. The following passage, again involving Griffin, provides an illustration of unilateral positioning narrated from a higher-status

position of both more vocal and more motivated. In this instance, Griffin reflects on an instance of working collaboratively with Justin in a small group (Obligation D1).

- 80 Griffin: ((laughs)) yeah, [Justin] was staying to himself. well, I'm not sure. I wasn't really sure if he was doing the problem or not, but I don't think so. I didn't actually check or ask him.
- 81 TS: so, do you think the way you participated would change a lot if you were with a different group?
- 82 Griffin: no, I would always try to talk. I would always try to be the first one who talks, and see if the other people started talking. because that's what I did with Justin here. I tried to keep talking to him, but then I would only get like one-answer replies. like, oh no I didn't do it, or something like that. so it was like, you can't keep the conversation going yourself. you sort of seem like an annoying person. so (hh) I just stopped talking, and just did the work.

In turn 82, Griffin indicates a position of greater motivation for himself relative to Justin. Griffin contrasts Justin's "staying to himself" after likely not having done the problem to Griffin's efforts to "be the first one who talks" and to get Justin to start talking. In the first two lines of turn 82, Griffin begins to generalize his willingness to "always be the first one who talks" regardless of with whom he is working, but then quickly refocuses on the specific instance with Justin, perhaps re-affirming his role as the more motivated participant in this pairing. The one-sided interaction Griffin describes ultimately results in his own avoidance of further attempts to fulfill the obligation in this instance, weighed against the risk of being perceived as an "annoying person".

Authoritative positions and roles are also characterized by descriptions of differential status in discursive instances; however, they are not described in the same one-sided terms as unilateral positions. Rather, both (or all) participants in an authoritative interaction are generally active and contributory agents in the discourse, but they take up complementary positions and roles that are characterized by unequal status. The term "authoritative" is chosen to suggest a relationship where unequal distribution of authority among participants is explicitly tied to the particular roles that are taken up. *Help provider* and *help receiver*, for example, are authoritative positions that typically act

as a complementary pair within a discursive interaction in which one student is narrated as helping another.

As with unilateral positions, authoritative positions are designated as either lower- or higherstatus relative to other participants in a particular context of discourse (see Table 6.3, rightmost column). Help provider, for example, represents the higher status role compared to the lower status role of help receiver. These status designations are related to a common association between providing help and doing so from a position of greater authority and competence, and conversely, receiving help from a position of less authority and competence. Other authoritative roles include *facilitator*, characterized as leading or maintaining the direction or flow of discourse, and *verifier/corrector*, which involves exercising mathematical authority through checking the correctness of problem solutions, calculations, or mathematical reasoning. Both of these roles are generally associated with a position of authority in discourse, and therefore both are designated as "higher status". In the following excerpt, Whitney narrates an authoritative role of verifier/corrector in describing an instance of collaborative work with Marco.

114	Whitney: uh, I'm just making sure of getting the right answer? or like the same ans- like
	we were on the same path that we- for that problem.

- 115 TS: okay?
- 116 Whitney: I was trying to verify if- [Marco] knew it with me.
- 117 TS: okay, would you say that you were verifying if he knew it, that he was verifying that you knew it, or you were sort of keeping tabs on each other?
- 118 Whitney: um, I would say to see if he was on the same path. cause I felt like I was doing the problem right? but it was kind of- well you could mess up pretty easily on that. so like on little things sometimes he- like if he had a certain thing or if I messed up on, like, a little thing or if he messed up on-

In turn 114, Whitney establishes that hers and Marco's collaboration is focused on verifying that they both have a correct answer, and comparatively checking for mistakes in their solution paths. In turn 116, however, Whitney specifies that she is taking on the verifier/corrector role from an authoritative, higher-status position. She elevates her status through her noting that she was checking whether or not Marco "knew it with me." In this phrasing, she suggests confidence about her own knowledge and correctness, and uncertainty about Marco's. This confidence is reiterated in turn 118 as she again describes their discourse as occurring "to see if he was on the same path," indicating a comparison of Marco's work to her own, rather than the other way around. Her stance is softened in turn 118 when she acknowledges the possibility that either of them could have made a mistake. Based on a pattern of self-described humility throughout Whitney's narratives, this softening may be interpretable as an act of further constructing a particular aspect of her intrapersonal identity, or else perhaps as a particular act of self-portrayal in the context of the interview, or as an act of re-interpreting hers and Marco's relative positioning instance to some degree. These possibilities will be explored using a framework of identity levels (Martin, 2000, 2012) in subsequent sections of this chapter and the chapter to follow.

Role Types and Relative Status

Thus far I have empirically established a set of discursive positions and roles from participants' narrative data and I have explored some of the status issues associated with each type of role. But as yet I have not addressed specifically how these status issues may be connected to students' identification with discourse. That is, do students identify differently when they engage in discourse from equipositional roles than they do from authoritative or unilateral roles, and if so, how?

I first addressed this question by looking again at intersections of code categories across all participant interviews, this time cross-referencing identification modes (affiliation, compliance, avoidance, and resistance) with the role types defined above (equipositional, authoritative, and unilateral). Table 6.4 shows the number of instances of each identification mode occurring for each

positioning code, with positioning codes grouped by role type (rather than by category as in Table 6.3 above). The table also shows the total number of instances of each positioning code, as well as totals from "affiliative" and "non-affiliative" modes placed in columns side-by-side for ease of comparison. Finally, the right-most column displays the ratio of "affiliative" instances compared to the total number of instances. This ratio portrays a comparative sense of students' affiliation versus non-affiliation for each positioning code. Higher ratios indicate more affiliative positions, lower ratios less affiliative. Totals shown under each role type provide a high-level characterization of how role types aligned with identification modes.

Table 6.4 shows that the total number of coded instances was similar among equipositional roles (71 instances), authoritative roles (60 instances), and unilateral roles (61 instances). That is, participants as a group narrated instances of taking up each of the three role types with relatively even distribution across role types. Furthermore, the table shows that some positions were associated almost exclusively with affiliation (e.g., mutual collaborator, verifier/corrector), others with non-affiliation (e.g., less competent, more motivated), and still others as a mix of both affiliative and non-affiliative modes (e.g., help receiver, more vocal, more competent). The former phenomenon represents perhaps the more expected case, where particular positions tend to provide affordances for building productive identities toward individual or collective goals in the classroom, while other positions tend to generate barriers toward such identities (e.g., see REFs). The latter phenomenon, in which a mix of identification modes occurs for a particular positioning, calls for further parsing.

		Ň	umb	er of	Cod	ed Ins	tance	es	
Role Type		AFFILIATION	COMPLIANCE	AVOIDANCE	RESISTANCE	TOTAL	Total Affiliation	Total Non-affiliation	Affiliation Ratio
	Collaboration\Mutual collaborator	9	0	0	0	9	9	0	1.00
	Friendship\Developing a connection with	2	0	0	0	2	2	0	1.00
	Friendship\Friend	3	0	0	0	3	3	0	1.00
	Motivation\Equally motivated	3	0	0	0	3	3	0	1.00
	Motivation\Willing participant in structured activity	1	0	0	0	1	1	0	1.00
	Vocality\Equally vocal	6	0	0	0	6	6	0	1.00
Equi-	Relative competence\Equally competent	19	1	2	0	22	19	3	0.86
positional	Friendship\Co-socializer	6	1	0	0	7	6	1	0.86
	Relative competence\Re-negotiating relative competence	6	0	1	0	7	6	1	0.86
	Friendship\Non-friend/non-acquaintance	3	0	1	0	4	3	1	0.75
	Relative competence\Unconcerned with relative competence	2	0	1	1	4	2	2	0.50
	Vocality\Mutually non-vocal	0	0	2	1	3	0	3	0.00
	Total Equipositional	60	2	7	2	71	60	11	0.85
	Collaboration\Verifier/corrector	4	0	0	0	4	4	0	1.00
	Collaboration\Help provider	11	0	3	0	14	11	3	0.79
Authoritative	Collaboration\Help receiver	26	5	4	0	35	26	9	0.74
<i>runoriunve</i>	Collaboration\Facilitator	2	2	0	1	5	2	3	0.40
	Contention\Challenger	0	0	1	1	2	0	2	0.00
	Total Authoritative	43	7	8	2	60	43	17	0.72
	Vocality\More vocal	8	2	3	1	14	8	6	0.57
	Relative competence\More competent	8	1	4	2	15	8	7	0.53
	Collaboration\Bystander/non-contributor	1	0	2	0	3	1	2	0.33
	Vocality\Less vocal	2	3	2	1	8	2	6	0.25
Unilateral	Relative competence\Less competent / lacking competence	1	3	7	0	11	1	10	0.09
	Contention\Being judged by	0	1	0	0	1	0	1	0.00
	Motivation\Less motivated	0	0	1	0	1	0	1	0.00
	Motivation\More motivated	0	1	3	4	8	0	8	0.00
	Total Unilateral	20	11	22	8	61	20	41	0.33

Table 6.4. Identification by Role Type

The passages below illustrate two disparate modes of identification that are associated with the same role of help receiver. In the first passage, Ajay voices his reaction after watching himself on video receiving help from another student during group work (Discursive Obligation D1).

80 Ajay: (5.0) I'm feeling mixed a little bit about this part. I feel comfortable to a certain point, but I also don't feel as comfortable? I feel comfortable to a certain point if I don't know it and then I try to ask others and they don't know it, type deal? because then that shows the we need something. we need to really get help. let's all finally figure this out together. I feel less comfortable because if- because- like, trying to get help from others only because I don't want- I know with some people, they like to give out answers, and I'm not the kind of person who wants to get out answers.

At first, Ajay describes affiliation in the instance while he participates from the position of mutual collaborator, but only "to a certain point". This "certain point" represents a transition to a new role as help receiver, with which he does not affiliate but avoids. His avoidance is further connected to him seeing himself in a certain way, as "not the kind of person who wants to get out answers." That is, Jay did not affiliate with the discursive instance any longer when his role changes from mutual collaborator to help receiver. His new mode of avoidance is tied not only to his interpretation of what it means to receive help in the workshop context, but also to his intrapersonal identity as one who wants to work toward solutions and not simply interpret answers that are given to him by others.

Marco, on the other hand, describes an instance in the following passage in which he affiliates with the role of help receiver, which occurred in the context of Whitney discussing a solution with the whole class (Discursive Obligation D3).

238 Marco: I think a lot of people have a- have a lot to offer. like I didn't know about Whitney until she went up to the board, and then I realized, you know, she actually knows a lot. It could be me? sort of selfishness, and maybe like I first think I know more than other people. like sort of an egocentricity- I don't know if that's the right word ((laughs)) 239 TS: I think that's a word ((laughs))

240 Marco: uh, but um- but I feel like a lot of people have things to share that are going to help me out and I can make the best use of that. yeah.

Marco's account also reflects a transition toward affiliation, connected to his re-positioning of Whitney with respect to her competence (turn 238). Through his noting of this transition, he connects his affiliation with the role of help receiver to his tendency to "make the best use of" what other students have to offer in the way of help. In this and other parts of his narrative, Marco ascribes this affiliation to an intrapersonal imagination of himself as an opportunist, in which he applies a "business approach" to get the most out of his time—and the contributions of his peers and the instructor—in the workshop. Contrasting Ajay's and Marco's accounts, some ideas begin to take shape about how identity-related factors at various levels play a role in their different takes on the same role of help receiver. For roles and positions in which there is a mix of identification modes, this comparative example suggests that understanding how mixed modes of identification occur across particular roles requires a deeper look at the interplay of the identity related factors described in Chapter 6. This approach will be taken up in the more detailed analysis of student subcases in Chapter VII.

Turning the focus back to more global trends, Table 6.4 also shows a characteristic difference among the three categories of role types in how often students associated them with affiliative versus non-affiliative modes of identification. Looking at the overall ratio of affiliation (rightmost column in Table 6.4), it is apparent that students describe affiliation as more frequently being associated with equipositional and authoritative roles than with unilateral roles. Figure 6.2 shows this result more explicitly in a 100% stacked column bar chart comparing the relative frequencies of affiliative and non-affiliative instances associated with each role type. Notably, equipositional and authoritative roles are associated with a similar, relatively high percentage of affiliative instances (83% and 74%, respectively). Unilateral roles are associated with a substantially lower percentage of affiliative instances (32%). The predominant pattern of affiliation with equipositional roles is consistent with the literature related to power and status in classroom discourse.



Figure 6.2. Relative frequencies of affiliation and non-affiliation associated with each role type.

A more nuanced interpretation is required for authoritative and unilateral roles. Both authoritative and unilateral roles hold in common that they typically involve differential-status interactions—i.e., those occurring between participants of higher- and lower-status positions. Yet, the bar chart in Figure 6.2 shows that the two role types differ substantially in how students identify with discursive instances in which they take up those role types. One interpretation of the difference is that the relative status of the role (i.e., higher status or lower status) has more influence on students' identification than whether the role occurs within an authoritative or unilateral instance. If students affiliate more with higher-status roles and less with lower status roles, then the difference may be based on the relative number of occurrences of higher- and lower-status roles within authoritative or unilateral categories, rather than on the categories themselves.

		Equal Status	Higher Status	Lower Status		
Role Type	Equipositional	85%				
	Authoritative		68%	74%		
	Unilateral		43%	17%		

Relative Status

Figure 6.3. Matrix of percent affiliation according to role type and relative status.

To investigate this possible interpretation, I used the "relative status" designations for each role (shown in the rightmost column in Table 6.3) to disaggregated authoritative and unilateral instances further to include higher- or lower-status designations. Figure 6.3 shows a matrix of the relative percent of affiliation for each role type according to relative status of the position taken up within the role type. For ease of visual comparison, Figure 6.4 represents the same data represented in a 100% stacked column bar chart comparing the relative frequencies of affiliative and non-affiliative instances associated with each role type.

Because equipositional roles are defined as being taken up from positions of equal status, the top row of the matrix in Figure 6.3 includes no entries for higher-status or lower-status instances. Similarly, authoritative and unilateral roles are specifically characterized as occurring in discursive instances marked by differential status of participants. Therefore, the bottom two rows of the matrix include no entries for equal-status instances. In short, instances do not occur in these matrix cells by definition.



Figure 6.4. Relative frequencies of identification modes associated with each role type.

Focusing on the relative percentages of affiliation (versus non-affiliation) for authoritative instances, Figures 6.3 and 6.4 show that affiliation does not vary substantially between the higher-status and lower-status authoritative positions, as might be expected if identification was closely related to relative status alone. Rather, students described affiliation with lower-status positions (74% percent of instances) about as frequently as they did with higher-status positions (68% of instances). A somewhat different pattern is evident in the relative percentages for unilateral instances, where a more substantial difference between higher-status and lower-status positions emerges. In this case, affiliation was described with a notably higher frequency when students engaged in discourse from higher-status positions (43% of instances) than lower-status positions (17% of instances).

To summarize, the patterns in this case study related to role type and relative status, students' descriptions of equipositional roles were predominantly associated with affiliation. Authoritative roles were also associated more with affiliation than non-affiliation, but to a slightly lesser degree than equipositional roles. Unilateral roles were associated substantially more with non-affiliation than affiliation. Further, there was little difference in affiliation between higher- and lower-status roles for authoritative instances of discourse. Authoritative instances were associated with affiliation more often than not, regardless of whether a student was participating in discourse from a lower- or higher-status position. Conversely, for unilateral instances, students described notably less affiliation for when participating from lower-status positions than from higher-status positions. With very few exceptions, students did not affiliate with discourse when they described themselves participating from lower-status, unilateral roles and positions.

Summary

The analysis described in this chapter demonstrated that students collectively invoked identityrelated factors from a range of levels in their descriptions of instances of discourse. In a "first pass" of analysis related to these factors, it was found that students raised identity-related factors as salient to their identification with discourse, but did so in ways that were complex, individualized, and situationalized for each participant. However, a prominent pattern did emerge at the classroom-level, where positioning surfaced as a singular, pre-eminent IRF across all participants. More specifically, the temporary, situational roles students described for themselves in discursive instances appeared in the data as the most-frequent and typically first-invoked factor in students' explanations of their modes of identification. To represent this emergent finding, the theoretical model of the study was amended to reflect the prominence of situational roles in the explanatory theory (see Figure 6.2).

Findings specific to situational roles suggest that their influence on identification was less connected to the descriptive categories to which they belonged (e.g., as related to competence, collaboration, friendship, etc.) and more connected to the relational typology they represented (i.e., equipositional, authoritative, or unilateral). Equipositional roles aligned primarily with affiliation, unilateral roles aligned primarily with non-affiliation, and authoritative roles were associated with a wider mix of identification modes that tended toward affiliation.

An additional finding related to the "primacy of positioning" was that students' descriptions of situational roles in discourse were often followed up with further explanations about why particular roles were taken up, or why students identified with a particular role in the way they did. It was in these "secondary" explanations that IRFs at levels outside of the workshop were often invoked. These invocations, however, were highly situational and individual, where few readily identifiable patterns emerging across the workshop case study as a whole. Consequently, in-depth subcase analyses of three students were conducted to explore the complex interactions between identification with discourse, situational roles, and IRFs across levels. These analyses are described in detail in Chapter VII.

CHAPTER VII. SUBCASE ANALYSES

In this chapter, I present subcase analyses of three students in the workshop. These subcases are intended to explore the complexities of identification with workshop discourse at the level of the individual student. In the classroom-level analyses described thus far, findings have indicated that students do invoke identity-related factors as salient to their modes of identification, and that students' positioning (as manifest in the situational roles they describe for themselves in discourse) represents a prominent and primarily influential IRF in students' explanations of identification with discourse across the case study workshop as a whole. As such, the influence of "situational roles" was separated out from the broader set of IRFs to indicate its prominence in the model (Figure 7.1). What remains unexplored to this point is *how* other IRFs acting across levels (bottom-center box in Figure 7.1) are specifically salient and influential to students' modes of identification. While IRFs were invoked by all student participants, their invocations reflect highly complex, situational, and individualized intersections among IRFs and identification with discourse.

Student-level subcases were therefore conducted to provide more detailed explanation of how and why individual students affiliate with, comply with, avoid, or resist participation in workshop discourse. In this analysis, the student becomes the unit of analysis in order to focus on the complex processes of identification. With respect to the iterative theoretical model, these subcase analyses are aimed specifically at which IRFs individual students invoke, and how these invocations interact with positioning and IRFs across all five levels (indicated with the large dashed circle surrounding the IRFs and identification modes).



Figure 7.1. Area of analysis addressed in subcases in Chapter VII.

As described in greater detail in Chapter IV, I conducted subcase analyses for three students: Whitney, an African American female student; Griffin, an African American male student; and Kaytlin, a white female student. These students were selected because their narratives in the phase-1 interview appeared to depict rich variations in the ways sociocategorical factors (i.e., race, gender, and class) played a role in the construction of their identities. As such, this subgroup of participants was uniquely situated for analysis of the connections they drew between these sociocategorical factors and classroom level discourse. While the salience of social categories was not the exclusive factor of interest in this study with respect to IRFs, it represented an area of particular focus for two reasons that have been previously alluded to. First, recent literature demonstrates the prominence of factors (e.g., those related to societal discourses around race, gender, class, language, etc.) in mathematics education, and their influence on students' success, failure, and opportunity to learn in mathematics. My analysis provides an empirical opportunity to make direct contact with those factors within the micro-level interactions in workshop discourse in a unique way—to investigate if and how students describe them as salient in their identification with moment-to-moment instances of mathematical discourse. Second, the design intentions of ESP are specifically geared toward facilitating a learning environment that supports success for students from marginalized groups. This intention invites a specific focus on how students who identify themselves with those groups invoke racial, ethnic, gender, class, or language categories as part of their identification in the ESP workshop. Further, the subcase analyses provide an opportunity to examine sociocategorical factors in an integrative way, documenting how they may intersect and interact with IRFs at other levels in workshop discourse.

I begin each subcase with a summary of the student's narratives from the phase-1 interview, in which the student described meaningful aspects of his or her identity at the sociocategorical, external-community, academic, disciplinary, classroom, and intrapersonal levels. Turning to data from the phase-2 interview, I then analyze these students' patterns of identification with workshop discourse. Looking at the roles the student takes up in discourse, I draw on connections to salient identity-related factors introduced in phase 1 to explain the student's affiliation or non-affiliation with those roles. Finally, I summarize trends and connections within and between the subcases.

Subcase Analyses as Explanatory and Descriptive

The analyses that follow provide somewhat lengthy and detailed accounts of three students' identity development both inside and outside of the workshop. In presenting the necessary details of these subcases, it is important to keep the larger picture of the study in view so that these details can be interpreted with their intended purposes in mind. Some explicit framing of the purposes of the subcases may be helpful here. The subcases are intended to provide a more nuanced examination of identification with discourse in relation to Guiding Question 2 of the study: What IRFs are invoked

in students' explanations? Beyond the simple question of "what factor?" though, the sub-parts of this question further probe *how* these factors might intersect with students' identification, as well as individual and situational differences. That is, what matters for students, from their perspectives, as they negotiate their modes of identification in instances of workshop discourse?

The "what factors?" question has already been addressed in the workshop-level analysis, at least in part. Workshop students invoked IRFs from all levels as salient to their identification with discourse, with some factors and levels emerging more prominently across the workshop than others. In particular, the factor of "situational roles" at the classroom level surfaced as uniquely prominent on its own, and was therefore examined extensively in Chapter VI. In a sense, this factor bubbled to the surface in the workshop-level analysis because of its frequency and consistency of invocation by *all* participants. Invocations of other IRFs, however, were far more individualized and situational. To further probe their role in identification, an examination was needed of how individual students raised IRFs—beyond those directly related to the situational roles they described—as salient to their experiences of workshop discourse.

To provide a bit of "theoretical foreshadowing," one of the early emergent findings from the subcases (which was also suggested in the findings from the workshop-level analyses) was that students often embedded these other IRFs in their explanations about the situational roles, rather than as directly related to their modes of identification. As an example, students might first describe a mode of affiliation with a situational role of "help provider," and only then invoke other IRFs (e.g., an altruistic intrapersonal identity or a family-related identity related to providing help) to explain why they might have taken up that role, or why they affiliated with it. In the reverse direction, students also at times (though less frequently) described how they negotiated situational roles to

influence their negotiation of identity-related factors². This mutual interaction between IRFs and situational roles played out in the subcase analyses in a prominent way, such that the theoretical model was adjusted to reflect IRFs and classroom-level positioning (i.e., situational roles) as interacting with each other in the ways students described their identification with discursive obligations. In Figure 7.2, this interaction is depicted in the lines connecting classroom-level positioning with IRFs at all five levels.



Figure 7.2. Final iteration of the theoretical model, depicting the interaction between situational roles and IRFs in the subcase analyses.

To frame the explanatory purpose of the subcase analyses, I use this final iteration of the theoretical model to guide the exploration of each of the three subcase students, highlighting how situational roles and IRFs interact in each student's descriptions, and how these interactions influence identification with discursive obligations. At the same time, I also frame these subcases as serving a descriptive purpose as well. In addition to documenting the particulars of how each subcase "fits" or "exemplifies" the overall theoretical model, each of these three students provides

² This phenomenon was primarily related to intrapersonal-level factors, and will be described in more detail when it arises in particular subcases.

an individualized, phenomenological depiction of identification in moment-to-moment instances of workshop discourse. While at the end of this chapter I will draw attention to some potentially meaningful similarities and differences among the three, each subcase can also be interpreted as a depiction unto itself, intended to illuminate, fill in, detail, and further problematize particular aspects of the theoretical model.

Subcase A: Whitney

Whitney is a self-identified African-American female student who was in the second semester of her freshman year during the workshop semester. At the time she was a chemical engineering major living in a residence hall on campus. An only child, Whitney grew up with her parents in an outerring suburb of the city in which the university is located. She attended a large public high school in the same suburb. The high school's state report card shows a diverse attendance population, reporting a relatively even mix of Black, Latinx, and white students. At the time of the study, Whitney was attending the university on a scholarship offered to African American students, and needed to maintain a B-average or better to retain the scholarship. In connection with the scholarship, she was a member of a university-sponsored organization offering academic advising, advocacy, structured learning communities, and a collaborative network structure for African American students on campus.

The workshop semester represented the second time Whitney was enrolled in the Calculus I course. She took the course in the Fall Semester of her Freshman Year, but did not receive the grade of C or better needed to continue on in the mathematics sequence required for her major. After registering for the course a second time at the beginning of the Spring Semester, Whitney's advisor in an academic network for African American students suggested she enroll in the ESP workshop.

Describing herself as someone who is usually determined to succeed on her own, and who has usually been successful in mathematics, Whitney took up her advisor's advice with some reluctance. She described having done so only after making a conscious effort to "set aside her pride and ego."

Mid-way through the semester, Whitney found that the decision seemed to be paying off. Success was coming more readily this time through the calculus course, in terms of both her understanding of concepts and her current grade average in the calculus course so far, which she estimated as one point short of an A. She noted that in the ESP workshop, the class was addressing problems and concepts that were not covered in the lecture or discussion section of the calculus course. With the other students in the workshop and with the help of the instructor, they were coming up with easier, more efficient ways to solve problems that were making more sense to her than the approaches she encountered the previous semester. Whitney thought that because of the smaller class size and the way they do things in the workshop, there was more give-and-take, more beneficial interaction with the instructor, and more opportunity to learn from peers compared with the calculus course.

In Interview 1, Whitney's narration revealed several key, interconnected themes related to her academic and mathematics identity, family identity, and African-American identity, as well as some of the ways she described herself at an intrapersonal level. A particular set of themes from Interview 1 are highlighted and described here particularly because of their salience in connection to the modes of identification she describes in Interview 2.

Intrapersonal identity

Whitney described several vivid perceptions about her tendencies in social interactions and relationships that appeared as relatively stable self-portrayal throughout her accounts. Her most

prominent self-portrayal was as a quiet introvert. In various accounts of events stretching back into high school, she described a preference to work on her own and a tendency to keep more to herself in both academic and non-academic settings. Whitney frequently mentioned this tendency in connection to her participation in the ESP workshop as well. At the same time, she coupled these references to introversion with a conflicted admission that she *ought* to be more interactive and vocal and would benefit from doing so, both academically and socially.

172 Whitney:	something I had to struggle with was that in the workshop I always want to
	work on problems by myself. and Philippe [instructor] will be like, you guys
	have to interact- bounce ideas off each other.
173 TS:	so that- you'd say you're more inclined to- when you're doing math, math is
	something you kind of do by yourself. has that changed at all?
174 Whitney:	yeah, a bit this semester cause I- like even for the exams, like I've gone to
	study groups and we've sat down in the library and worked out problems
	downstairs. before I would just go to the computer lab and get problems
	online by myself, and just go through it.
175 TS:	so how are those two experiences different to you?
176 Whitney:	I still like doing problems by myself, but at least when you're with a group if
-	you- like if I did something wrong, they could tell me it's wrong. and like if
	I'm sitting by myself and I'm not doing it right, I wouldn't know.

Whitney implies her sense of ought-ness about interacting more, but also suggests at times she actively participates in academic discourse in ways that run counter to her sense of herself as an introvert. Here she offers a brief revelation of her ongoing identity construction—of her existing, apparently stable sense of herself as one particular type of person becoming another in academic situations where she perceives a benefit for doing so. As I will show later, however, Whitney's identity as an introvert was not completely or immediately supplanted by some new construction of herself. She certainly referred to introversion as a salient factor in subsequent descriptions of episodes, but as she contested and pushed the boundaries of her own self-ascriptions, her identities both inside and outside of the workshop were rewritten in meaningful ways.

Whitney also often referred to low self-confidence and a heightened sense of empathy as self-tendencies that were intertwined with each other. For example, she explained in an interview how, during a group work activity in a previous mathematics class, she did not join the discussion because she did not want to "slow the group down" with questions about things she did not understand. She reflected that she felt this way because she did not feel confident enough to ask for what she needed from the group, but also that she did not want to waste other people's time on something they might have already understood.

Academic and mathematics identities

In middle school and high school, Whitney primarily enrolled in honors courses and was counted among the "smart kids" in school. In keeping with her strong sense of empathy and humility, she was quick to qualify that to her this did not actually equate with being smarter, but had more to do with "knowing different ways of going about learning" that helped her and her classmates achieve success in the higher-track classes. Yet she consistently felt like she struggled in her classes compared with other students. Despite her difficulties and the extra effort required, she persisted in the honors track and enrolled in a number of Advanced Placement courses during her junior and senior years. As her struggles increased, her mother encouraged her to drop down into the regular classes, advising her that an A in a regular class would be better than a C in an Advanced Placement class. Yet Whitney felt the need to persist in order to live up to the expectations of her friends not enrolled in the higher-track courses who characterized her as "super smart," even though her struggles continued to wear on her confidence.

Throughout her schooling, Whitney felt like she was particularly good at mathematics, and that mathematics was her favorite subject area. This was in part because of her sense of competence

in the subject, but also because she appreciated the clarity of mathematics, a subject in which she saw little ambiguity about whether an answer was correct or not. She found that her success in mathematics was a source of confidence because of the difficulty with which most people perceive it. Her confidence began to waver, however, in her precalculus course in her junior year of high school. This was her first experience where success was not automatic and effortless, and she had to make significant adjustments in the amount of effort she applied to be able to understand the concepts.

Sociocategorical and community-level identities

Whitney described a strong African American identity narrated both in terms of her impassioned sense of African American pride, as well in terms of deeply racialized experiences from her previous schooling. Through these narrated accounts Whitney demonstrated how the construction of her African American identity was intertwined with the construction of her family identity and her academic identity. The nexus between her African-American identity and family identity, for example, is evident in this account from Interview 1.

322 Whitney: in my family, they're so into Black pride... and just like really being proud of that? so I think I get really intense- like really into it sometimes, where like, other people- like sometimes I don't care about how other people take it. even my family will be like, it's a little intense. but when you're passionate about something-

Whitney initially refers to her family's impassioned sense of African American pride, indicating her family as external to herself in their activism, i.e., *"they're* so into Black pride" (italics added). In the second sentence, however, she indicates a personalization of that sense of pride, seamlessly transitioning to the first-person: *"I* get really intense..." (italics added), to a point beyond her family's level of intensity. Notably, Whitney narrates her African-American identity here such that

she is unconcerned about others' reactions to it. This narrative again runs counter to the intrapersonal self-portrayal Whitney revealed earlier, in which she described herself as under-confident and overly empathetic. This indicates a nexus of identities in which various aspects of Whitney's intrapersonal identity may be contested and eclipsed by other aspects in particular situations.

A few turns later in the interview, Whitney expands the construction of her African American identity, extending beyond her family to her expressed sense of "we-ness" with the broader African American community.

328 Whitney: like where you're just proud of where you're from, what you look like. what you- how you say things, how you do things. sometimes that just gets so downplayed. like some of the things we do, what we say, how we dress. it's not as good as societal standards? so you should like it either way- you should love it no matter what others think.

The expansion continues in her description of the African American community's being positioned as inferior by society overall. It is notable that Whitney does not narrate a contentious or combative stance against this positioning, but rather turns the positioning towards a strengthened stance of pride in and love of her own African American identity. Although her reflections here may be especially influenced by the context of occurring in an interview with a white researcher, her response may be indicative of a resilient form of stereotype management in McGee's (2009, 2015) framework.

Whitney also constructs her African-American identity through her racialized experiences in previous academic settings in less positive ways. Although there were numerous African American students in her high school and she had a close group of African American friends, Whitney was often the only African American student in her honors and Advanced Placement courses. This contributed to her being seen as "super smart" among her Black friends who were not in the honors classes, which provided further motivation for her to succeed as a way to live up to her friends' expectations. As such, she often felt isolated academically, carrying an unspoken sense that white

and Asian student in her honors classes believed she did not belong there, and that they perceived

her as "less smart and lazy." The impact of these perceptions was two-fold. First, Whitney described

struggling not to succumb to the stereotype whenever she felt unmotivated academically. Second,

she felt unable to reveal any academic difficulties to her classmates for fear of reinforcing their

preconceptions. At the same time, these struggles were not experienced in the same way by any of

her African American friends in the "regular classes", further contributing to isolation.

Whitney's sense of non-belonging extended to some of her teachers as well, as she painfully

recounted an interaction with her precalculus teacher from her junior year.

334 Whitney:	well, cause they always expect you to be like, less smart and lazy when it
	comes to school in my math class junior year my teacher- I remember I was
	doing really bad, in that class. I actually tried to go to her to get help after
	school. and so I felt bad. when I went up to ask one question, she was like,
	well, why don't you get this already? and I said, I don't really understand the
	concept in general. could you explain it? and she was like, I've explained it
	before so maybe you should go back and like look at it again, or like practice
	it. so then I would feel bad, going back up again to ask her to really explain it
	to me again.

- 335 TS: what did you think she was-
- 336 Whitney: she called me out also one time in class too.
- 337 TS: how did she call you out?
- 338 Whitney: she like brought me up to the desk in front and she was like, are there problems going on at home? like, why aren't you doing well? I was like, nothing's going on at home, I just don't really understand it. and she was like, well if that's the case, then I don't really understand why you're doing- you're not doing well, or something like that.
- 339 TS: and that- so what was your response to that? did you say anything, or what was going on?
- 340 Whitney: I think at the moment I was first- like I was really embarrassed because I felt like other people could hear her. so, like I always want to cry when I get frustrated. like I cry about anything when I get angry. so I thought I was going to cry so I just walked out and didn't come back to class.

At the university, Whitney connects with her African American identity through a campus

organization that provides advising, services, and collaborative academic support among African

American students on campus. In particular, Whitney describes the organization as a community

where she can just be with other African American students and advisors—particularly at times when she is feeling dejected—and can know that other people there are going through similar experiences. Whitney suggested that her sense of introversion keeps her from visiting the Learning Center as often as she otherwise might, and that she seldom participates despite her positive experiences with the organization and their frequent attempts to reach out to her. When she does go to the Learning Center, it is typically to work one-on-one with an advisor or tutor, rather than to join the groups of students who often come to interact socially or academically.

Whitney's modes of identification and discursive roles in the workshop

As was discussed in Chapter 6, Whitney identified with discourse in the ESP workshop in a range of modes. Specifically, she described 17 discursive instances of affiliation, 7 instances of compliance, 6 instances of avoidance, and 1 instance of resistance. Clustering these instances into affiliative and non-affiliative categories, Whitney described affiliation with 17 of 31 (55%) recounted instances of discourse, and non-affiliation with 14 of 31 instances (45%) recounted instances of discourse. Relative to other participants in the case study classroom, this represents a fairly even distribution of affiliation to non-affiliation. In Chapter 6, I categorized Whitney as "mixed" with respect to her modes of identification.

In this sub-section, I will describe a detailed analysis of Whitney's explanations about her participation in discourse as a way to understand why her accounts varied between affiliation and non-affiliation as they did. To do so, I will analyze Whitney's accounts using the analytical constructs and classroom-level findings outlined in Chapters 6 and 7, in connection with the identity factors she described in Interview 1, summarized in the previous sections of this chapter.

It is important to recall from Chapter 7 that the classroom-level positions and roles described by students during discursive instances were found to be highly salient with respect to identification, both in terms of frequency with which students linked particular positions to identification modes, and in terms of how positioning was consistently the initial factor implicated in students' accounts of identification with discourse. Further, roles categorized as *equipositional* were found to be generally associated with affiliation. Roles categorized as *authoritative* were also found to be generally associated with affiliation, though less consistently than equipositional roles. Roles categorized as *unilateral* were found to be generally associated with non-affiliation. All three categories, however, were experienced with some mix of affiliation and non-affiliation.

Analysis of Interview 2 shows that Whitney primarily described roles/positions related to *vocality, collaboration*, and *relative competence*. In this subcase analysis, I aim to understand specifically when and why she identified with these particular positions during discourse, especially when her mode of identification ran counter to the broader trends associated with each role type (i.e., equipositional, authoritative, and unilateral), or when there were variations in her own modes of identification for a particular role. For example, why might she have avoided discourse in an instance where she saw her positioning as equally competent to a group work partner; or why might she have affiliated with being a help provider in one instance, but avoided the same role of help provider in another instance? Finally, the subcase analysis was intended to understand why Whitney may have taken up the particular position she did within an instance of discourse.

Whitney and vocality

With respect to vocality, Whitney describes two positions in discourse: 1) equally vocal and 2) less vocal. It is noteworthy that she never describes herself in a position of being more vocal, which

appears to be consistent with her intrapersonal self-portrayal as an introverted person from Interview

1. Following the overall group's trend of affiliation with equipositional roles, Whitney describes affiliation in equally vocal roles in two significant instances in her accounts in Interview 2. Below is an example of an instance in which Whitney describes equal vocality. In this excerpt, she was explaining why she felt particularly engaged in a videotaped segment in which she was working collaboratively with Griffin, another African American student with whom she frequently chose to collaborate in the workshop.

231 Whitney: um, maybe that it's easier to- well cause you don't feel as pressured here to maybe say if you have the right answer or not in this one? not that I don't think Griffin is really smart, cause I think he's really smart too. just cause-maybe cause he can be kind of quiet, like- well, maybe we're similar- when it's like similar people, like we're quiet but we still kind of want to- like genuinely want to understand how to do it? it's easier to, like put yourself out there.

- 232 TS: connecting with some things you talked about in the first interview, does it matter that Griffin is African American?
- 233 Whitney: it might be unconscious- it might be really unconscious that I don't always- I don't think of it. but yeah, being Black is a similarity between us so- it is always easier to talk to someone who's just like you, so- I don't even, yeah I don't even think I think about it. it might just be unconscious.

Whitney's affiliation in this discursive instance is evident at the end of turn 231 when she states that it is "easier to put yourself out there." An equally vocal position is indicated in her description of her and Griffin being equally quiet, but both willing to contribute when they feel it is appropriate or necessary to do so. So again, the affiliation is not surprising in how it aligns with the overall trend of students' affiliation with equipositional roles. However, this instance sheds light on how identityrelated factors influence the evolution of Whitney's equipositional role in this context with Griffin. In turn 231, Whitney again implicates her imagined self as an introvert who likes to solve problems on her own. Through her ascription of that same trait to Griffin, she constructs a role of equal vocality with respect to Griffin. Their shared introversion in turn influences her affiliation with instances of discourse with Griffin, where she finds it "easier to put yourself out there" with someone who approaches partner talk in a similarly understated, non-obtrusive way to her own approach.

After further reflection is prompted about whether Whitney's and Griffin's shared African American identity matters in this instance (turn 232), Whitney's response indicates that it does, though possibly in a way that is "unconscious." In this instance, Whitney does not explore this aspect of their relationship in detail. However, her statement that "being Black is a similarity between us so- it is always easier to talk to someone *who's just like you*" (italics added for emphasis) suggests that the African-American identity she shares with Griffin at a sociocategorical level is connected to her affiliation with this discursive instance through the playing out of their equally vocal roles. Her use of the phrase "just like you" is especially interesting in this regard in that elsewhere in Interview 2 Whitney does not claim any particular friendship or familiarity with Griffin. Rather, the substance of Whitney's sense of connection and likeness to Griffin resides in their shared introversion and their shared African American identity, both prominent aspects of Whitney's identity narration in Interview 1.

Again following overall trends of the group, when Whitney is in a position of being less vocal (a unilateral role of lower status), she tended not to affiliate with discursive instances but rather described avoidance or compliance. This positioning occurred for Whitney primarily in instances of small group work with students other than Griffin. In this recalled instance, for example, Whitney reflects on working in a small group with Marco, a friendly but somewhat assertive male, Latinx student.

236 TS: is it different with students other than Griffin? like here working with Marco? ((Points to still shot on video screen from previously shown clip of Whitney and Marco working together))

237 Whitney: yeah, maybe. I think just more so because [Marco] is just so, so assertive with how he- how he goes about what he knows and what he doesn't know. so I just try to put myself out there a little bit more with- I think I feel I have to try a little harder. um, yeah. I don't know maybe I feel like I have to prove it a little bit more.

Whitney's compliance here is indicated by the lexical cue of "have to try" in turn 237. That is, she is willing to try to contribute to the discourse, but her efforts are framed as an obligation to Marco in order to prove her competence³ to him rather than as an obligation to herself with respect to a collective goal of solving of problems in small groups (Discursive Obligation D1).

In this instance, the same two identity-related factors are implicated as in the previous example with Griffin: Whitney's sense of introversion at the intrapersonal level and her African-American identity at the sociocategorical level. Whitney's statement in turn 237 that with Marco she "tries to put [herself] out there a little more" relates to her previously narrated tendencies to work quietly on her own, and is also a stark contrast to the ease with which she reports "putting herself out there" with Griffin. So the question arises as to why Whitney would contest her own deeply constructed identity as an "introverted person" in the context of collaborating with Marco on a calculus problem, particularly in light of Marco's assertive, highly vocal approach. One instead might expect Whitney to be less likely to make contributions as an introvert working with a vocally dominant partner. However, her non-explicit statements of "I just try to put myself out there a little bit more with-I think I feel I have to try a little harder... I have to prove it a little bit more" may possibly (though not unequivocally) be interpretable in terms of her African American identity. In this excerpt she was specifically responding to a question comparing her interactions with Griffin whom she identifies as

³ In addition to a position of "less vocal," this excerpt can also be interpreted as Whitney portraying herself in a position of lower relative competence. I chose to analyze the excerpt in terms of vocality because of the more direct implication of vocality in the instance, even though it was coded as an occurrence of both positions. This overlap is evidence of the interconnectedness of how positions are taken up in discourse, a phenomenon that bears further investigation, but is not a central focus of this analysis.

African American (and whose common African American identity was counted as salient in the previously described instance) and Marco who is not African American. Although in explicit terms she identifies the difference as being about Marco's assertiveness, one cannot ignore a connection between her need to "prove it a little bit more" and her previously shared racialized experiences of her being considered less capable academically because of race. It is also seems reasonable to infer that her hesitation to make the connection explicit may be about not wanting to implicate Marco directly in a racialized experience in an interview with a white researcher. In this case, I interpret that from her less-vocal positioning, Whitney complies with, rather than avoids (or resists), the obligation to engage in discourse in part because her African American identity is brought into the negotiation of the discursive space with Marco. She remains less vocal, but asserts herself more than she otherwise would in order to comply with an obligation to another—in this case, Marco.

Whitney and collaboration

In workshop discourse, Whitney described herself in collaborative roles of help provider and help receiver. In the role of help provider, Whitney fluctuated between avoidance and affiliation modes. The following passage provides an example of Whitney describing avoidance of helping her peers when collaborating in a small group.

40	Whitney:	it looks like I was kind of like hesitant to, like, help at some points. it looked
		like I would reach out a little but I wasn't sure if I should say anything?
41	TS:	what makes you think that? what makes you think that from what you saw?
42	Whitney:	um, cause sometimes I don't know if they want to, like, figure it out on their
	-	own, or maybe I don't even have the right answer

Whitney's use of "hesitant" in turn 40 indicates avoidance of the role as help provider. Her spoken rationale in turn 42 suggests that she sees two separate aspects of her intrapersonal identity bearing on her avoidance. First, she articulated a low level of self-assuredness in questioning whether she is

qualified to provide help based on uncertainty about the correctness of her answer. This uncertainty is in contrast with classroom observation data showing Whitney consistently providing viable solutions in the workshop. Second, her self-perception as an empathetic person is implicated in her hesitation when she expressed sensitivity toward her group mates' possible preference to "figure it out on their own." This sense of empathy surfaced again in a different instance in which Kaytlin was writing a solution at the board for a whole group discussion (Discursive Obligation D3). Whitney again described her own avoidance of discourse in the role of help-provider with Kaytlin.

- 257 Whitney: I saw that [Kaytlin] wasn't going to get the right answer- or at least I thought that my answer was right, so I thought her answer wasn't going to be right because the way she was going about it wasn't necessary, I thought. so I kind of thought I should say something, so I kind of reached out a little, but then I pulled back and then I didn't say anything, but-
- 258 TS: so you-
- 259 Whitney: cause I wasn't sure if, like-
- 260 TS: what made you pull back?
- 261 Whitney: I know at least in my experience that sometimes I just want to do it by myself and figure it out? I don't know, like I want to go through it and get an answer and then maybe someone else gives me feedback? I felt like I shouldn't interrupt her and say, hey you're going about this- I don't know, that's just like how I would feel about it if someone interrupted me and said hey I don't think you're doing this right.

In this instance, Whitney's sense of her own independence and introversion was again salient to her

mode of identification, but this time in the way she projected this perception of herself onto Kaytlin.

Since Whitney would not want to be interrupted by outside help herself, she presumed the same

would be true for Kaytlin through a sort of empathetic, Golden-Rule interpretation of the situation

that ran counter to the discursive obligation in the workshop.

In other instances, however, Whitney described affiliation with the role of help provider, as

in the following example during small group work. In this instance, she viewed taking up the role as

an opportunity to build her own confidence.

- 189 Whitney: I think sometimes, uh- (3.0) you have to like fake confidence even when you don't have it. so, maybe if- and I don't always think I come off as confident in the workshop, but like this time where I don't feel super confident about it, I kind of tried to help someone out anyway? be like, hey this is what I got, even if ((laughs)) it might not be the right answer.
- 190 TS: mmm. so what did helping someone out do for you in that situation?
- 191 Whitney: for me?
- 192 TS: yeah-
- 193 Whitney: uh, build- I don't know it builds confidence maybe for me. like fake it till you can make it. ((laughs))

In turn 189, affiliation is indicated in the phrases "tried to help someone out," which implies an active stance toward the discourse and "...it builds confidence maybe for me," (turn 193) indicating she viewed participation as an obligation to herself. In this case, her affiliation was directly associated with her intrapersonal self-ascription of being under confident. Rather than her under confidence leading to avoidance, however, Whitney's response here suggests a contestation and reconstruction of this aspect of her identity toward a more confident self in the workshop community. Her affiliation with the role of help provider is interpretable as being connected to a newly imagined self that Whitney is becoming—thus far only "faking it", but building the confidence to ultimately "make it".

In the role of help receiver, Whitney tended to merely comply with discursive obligations.

After viewing a video clip where she described herself as stuck but not wanting to ask for help from a partner in small-group work, she again attributed this to her sense of herself as an introvert with a

preference to work independently.

287 Whitney: um-- I don't naturally like working with people. I just- I don't know. I feel like I'm just more really introverted and I'd rather, like, figure it out on my own? but I know, like, it's good to bounce ideas off of other people so you know if what you're doing is right or not? but I would rather just sit and do the problems by myself. but I know that's not the best method to learn, so that's why I say-
And again, her explanation is somewhat conflicted, pitting her deeply held tendencies against her recognition of a benefit of receiving help from other students in the form of feedback. In virtually all of her descriptions of being in the position of help receiver, however, she tended toward avoidance of receiving help from others.

The exception to this pattern was when the help was provided by the instructor, as demonstrated in her description of receiving help from the instructor, Philippe.

237 Whitney: I feel like I ask Philippe a lot of questions. like when we work in groups I'll ask him to come over and like, look at my work? but like I- in a [calculus discussion section] setting with TAs, I don't think I usually do that. I don't know if it's just the class- I thought maybe it's this class is smaller, but it could just be like an unconscious thing cause we're both- like it's easier to talk to him cause we're both Black, so- I don't know.

Affiliation was indicated in Whitney's active requests for help from Philippe, which were a particularly notable contrast to her avoidance of receiving help from peers where her sense of introversion clearly held sway. In this excerpt, Whitney initially attributes her affiliation to the small class size of the workshop in comparison to the TA section. She is perhaps more inclined to leverage Philippe's help as an available resource in the workshop setting because, by contrast, help from the TA is unavailable in the TA sessions. Although she does not state it explicitly, there may be a safe assumption that her affiliation in this context also has to do with the elevated status of the workshop instructor as a higher mathematical authority within the classroom community, and that receiving help from him would not potentially diminish her status in the same way as if she accepted help from peers.

Beyond these classroom-level interpretations, her affiliation with receiving help from the instructor is a particularly important phenomenon with respect to sociocategorical-level factors. Whitney's additional rationale for affiliation—that "it could just be like an unconscious thing cause

we're both- like it's easier to talk to him cause we're both Black"—reveals another important set of connections Whitney makes among her identification, positioning, and African American identity in this instance. As a matter of context, it is notable that Philippe is not African American, but an African immigrant who speaks with a fairly heavy accent. Her description of affiliation mirrors that of described in her equally-vocal collaboration with Griffin, who is African American. Recall that in her accounts of working with Griffin, Whitney revealed no details of a particular personal connection with Griffin, other than their connection as African Americans. The situation is similar with Philippe. During the interviews, Whitney did not describe any aspects of Philippe's demeanor or approach to instruction that might have made her more inclined to seek his help. Rather, their shared Blackness appears to be the sole and most salient connection that she makes, specific to Philippe, influencing her comfort level with asking him for help. Looking at both of these instances together, a pattern emerges with respect to Whitney's interpretation of her own African American identity as being explicitly salient in her identification with particular discursive obligations and roles in the workshop. The pattern emerges further in her positioning related to relative competence.

Whitney and relative competence

With respect to relative competence, Whitney's describes herself at times as a less competent participant and at times equally competent. To a large extent, her patterns of identification are fairly consistent across these positions, and generally align with what might be expected from broader patterns among students discussed in Chapter X. Whitney tends to avoid or merely comply with discursive obligations when she occupies a position of lower competence. She tends to affiliate with discourse from positions equal competence, with one particularly important exception that I will explore further on. Because these modes of identification are fairly consistent and aligned with the

broader trends, I turn the focus of analysis here toward an exploration of *why* Whitney occupies these particular positions of competence.

One notable pattern appears in several of Whitney's descriptions about her positioning as less competent. Whitney associates her sense of lower relative competence more with an intrapersonal sense of her own perfectionism and shortage of self-confidence than with her actual level of understanding of disciplinary content. That is, intrapersonal factors related to confidence appear more salient for Whitney than classroom-level disciplinary content factors when it comes to her assessment of relative competence in discursive situations. An example of this occurs in an instance in which Whitney presented her solution to a problem related to finding inflection points and concavity for a polynomial function (Discursive Obligation D2). After she has explained her solution to the class, the video clip (that Whitney was shown in Interview 2) showed the instructor,

Philippe's, response:

134 Philippe: okay. (stands up from seat and approaches the board)) here she put (5.0) now the second derivative is positive here and here. she put concave up here. well, I would have liked to see, just to make it clear, "concave up" on this end. ((points to the right end of the number line)) I think she did a really good job on this.

Whitney reflected on the instance—and particularly on Philippe's feedback—in the following

excerpt.

- 138 Whitney: um, I actually remember this one... it's just sometimes I hate going to the board because I don't want my answer to be wrong when I go on to the board? but Philippe has to correct something maybe? so I get a little nervous about it.
- 139 TS: and what was your response to that? did you have a reaction?
- 140 Whitney: uh, a little. just cause I wanted everything to be right ((unintelligible))
- 141 TS: okay, so is that your, like, main hesitation of going up to the board?... do you feel that way about every time that you go up and present to the class?
- 142 Whitney: yeah, I hate- I always hate going up especially if I didn't finish the problem or if I'm not sure if I have it, then I don't like going up to the board, even though he says, you know, it's not about having the right answer. I would rather have the answer.
- 143 TS: [otherwise] what are the consequences for you?

144 Whitney: um, then I feel maybe like I don't know it as well as I think I do, the material. so then, I think I question myself a little bit.

I characterized this reflection as demonstrating compliance with Discursive Obligation D2. While Whitney did not indicate any attempt to actively avoid going to the board, her dislike of this obligation in this instance (and in general) was clearly stated in turn 138, and implied that she did not carry it out as an obligation to self. Her account here aligned with my observations of her overall patterns of participation in the workshop. She seldom if ever volunteered to write her solutions on the board. When asked by the instructor to do so, she would comply but would offer very little in the way of verbal explanation, generally only responding in short answers to direct questions from the instructor or her peers about her solution. As was the case in this instance, her written solutions were generally complete, correct, and often endorsed by the instructor as exemplary.

In turns 138 and 140, Whitney begins to hint at a sense of perfectionism she has about herself that contributes toward her aversion to board work. The fact that Philippe made a small addendum to her solution in the video clip seemed to catalyze Whitney's aversion to this obligation, but it does not appear to be rooted in her "wrong answers" potentially being exposed to others. Rather, her reflection here culminates in a greater concern that she will come to realize that "I don't know it as well as *I* think I do... so then I think I question *myself* a little bit (turn 144, italics added for emphasis). Outwardly, Whitney demonstrates a sound understanding of the mathematical concepts and procedures involved in the problem. Inwardly, she seems to have no concerns about any specific difficulties with specific content related to the problem, and makes no references to difficulties related to finding or interpreting the derivatives in the problem. Yet, she demonstrates that even minor adjustments suggested by the instructor might destabilize her sense of her own competence. In turn 142 she again generalizes to other situations of going up to the board, noting a particular aversion when her solutions are not complete or she is not certain about the correctness of her

answers. Despite her understanding of a discursive norm in the workshop in which wrong answers are okay and working through mistakes should be taken as an opportunity to learn, Whitney has not internalized this aspect of the obligation, which is in conflict with her self-ascribed sense of perfectionism, low self-confidence, and tendencies toward independent work. Essentially, she has created a connection between her own concerns about her competence and some of these same pervasive intrapersonal factors that have already been shown to influence her identification across a number of instances.

More often, however, Whitney describes participating from a position of equal competence with respect to her peers. Her frequent accounts of equal competence consistently portray a mode of affiliation, and they typically occur in the context of small group discourse (Discursive Obligation D1). Again, this aligns with the more general trends as they have emerged in the group of participants. However, Whitney's construction of her equal competence with peers becomes more complex when interpreted through a lens of intrapersonal and sociocategorical factors. In the following excerpt, she reflected on an instance where she was providing help to a peer in small-group work (Discursive Obligation D1). Initially she described the instance in terms of her role as help provider, but the interview then moved into a reflection about her down-playing her own competence within the context of providing help, and her explanation for why she did so.

199 Whitney: ...I know how that feels, like when you're working with someone and they come off like, they don't have to work as hard-like try as hard cause they already know it? and then-I don't know it just makes you feel- uh, less? and I don't like-I don't ever want to come off like that-like I know more than you or like I'm better than you? I-I don't like that. ((laughs))

Although Whitney initially described herself as equally competent relative to her group mates, her reflection in turn 199 suggests that she may have seen herself in a position of being more competent, but that her sense of empathy influenced her not to "come off like that- like I know more than you or

like I'm better than you," contrary to her self-assessment of being more competent than her group mates in that instance. In this way, Whitney is agentic and strategic in negotiating her role in order to create a more equipositional situation, which she perceived as more comfortable for both her peers and herself in the small-group context.

Her sense of empathy was complex and evolving, however, in that she was beginning to view it as something to overcome in particular situations. Several turns later, for example, a follow-up question is asked specifically related to the sense of empathy Whitney raised in turn 199.

- 206 TS: is that a pretty important driver in your life? how something will make somebody else feel?
- 207 Whitney: yeah, I think sometimes I feel like I care too much about how other people feel? I'm trying to work on that because sometimes I don't want to care because they don't care about you as much as you try to care about their feelings? so I feel like I try to work on that where I feel like I don't care as much about it.

Here Whitney articulates a realization that empathy is often not reciprocated, and therefore seems to be aiming toward recalibrating her own sense of empathy in those situations when it might not be valued by the other. In the following example, this recalibration seems to have a direct impact on Whitney's identification with discourse. The excerpt is from Whitney's account of an instance of collaborating in small-group work (D1) with Ajay, who Whitney and several other students in the workshop frequently describe as stand-off-ish and aloof. Although Whitney viewed herself as equally competent with Ajay, she also believed that Ajay saw himself as more competent than her, and that he was therefore disinterested in meaningful collaboration. In this discursive situation with Ajay, Whitney recalibrated her concern about what others think, and notably avoided an equipositional instance of discourse.

74 Whitney: here I backed off a little. um, with Ajay? I think he comes to workshop where he feels like he doesn't always need to be there? so- cause he thinks he has it-like he knows how to do it in his head already so he won't do it on the- on

	paper? so, when we'll do a problem and he's like, well I already know how to do this, so, you know, he doesn't say anything. I'll be like, well maybe I know how to do it too, but I guess I won't like, tell him if he's right or wrong.
TS:	why is that?
Whitney:	um, because if he already feels like he knows it, I don't know if I feel the need to say it? I feel like it should be opposite- I think it's backwards.
TS:	that's interesting that you feel it should be backwards. why do you feel like it should be backwards?
Whitney:	because, well shouldn't you feel like you should assert yourself more to the people who don't think- who like think they're smarter than everyone else? like to prove that they're not just the smartest one?
TS:	oh, okay. so if it's just about a person proving they're smarter, then what's the point?
Whitney:	yeah.
TS:	so you proving something is not that important?
Whitney:	mmm, not so much anymore, I think.
TS:	was it at some point?
Whitney:	um, a little- I would say maybe more so like last year? but I don't really think so this year.
TS:	why the difference?
Whitney:	I think I cared too much about how people see me? I feel like I should- I just don't care anym- so much anymore.
TS:	so you don't care about how people see you as much- did caring about something else take the place of that?
Whitney:	I think just not caring how other people- not that I don't care at all, just not to like the same extent, because, like it doesn't make me feel any better if I know it or not, like- I don't know.
	TS: Whitney: TS: Whitney: TS: Whitney: TS: Whitney: TS: Whitney: TS: Whitney:

In turns 76-78, Whitney is renegotiating her mode of identification. As she moved toward avoidance of discourse with Ajay, she wrestled with her own sense of ought-ness in the situation, considering it a sort of moral obligation that she should assert her own competence to disprove Ajay's assumptions, but ultimately choosing not to. Her agency in this choice represents a turn for her toward renegotiating her identity at the intrapersonal level. This renegotiation plays out explicitly in discourse with Ajay, but also seemingly across other contexts as well. In turns 84-88, Whitney describes the renegotiation as occurring over the last year or so, though perhaps being reified in her reflection on this instance as a larger-scale transformation of her intrapersonal identity as caring less about the perception of others.

Subcase summary: Whitney

Figure 7.3 represents what I will refer to as a summative *portrayal* of Whitney's identification with ESP discourse. I use the term portrayal to capture the notion that it is not intended to essentialize a "factual" version of these phenomena in Whitney's subcase, but instead represents a broad portrayal of her own performance of identification that occurred both in the workshop and in the interviews (with the interviewer as a co-performer in the latter).

	Identity-Related Factor	Discursive Roles in ESP Workshop	Identification Mode	
	SOCIAL CATEGORIES:			
		Collaboration: Help receiver		
ΈL		Competence: Equally competent	Affiliation	
LEV	African-American identity	Vocality: Equally vocal		
0		Vocality: Less vocal	Non-affiliation	
> MACR	EXTERNAL COMMUNITIES: Few or no direct connections to ESP discourse			
	ACADEMIC/DISCIPLINARY IDENTITY: Few or no direct connections to ESP discourse			
	CLASSROOM LEVEL (Non-positioning factors): Few or no direct connections to ESP discourse			
	INTRAPERSONAL IDENTITIES:			
	Empothy	Competence: Equally competent	Mixed	
	Empathy	Collaboration: Help provider	Non-affiliation	
Ý,		Vocality: Equally vocal	Affiliation	
VEI	lature and an	Vocality: Less vocal		
ΓÈ	Introversion	Collaboration: Help provider	Non-affiliation	
20		Collaboration: Help receiver		
llCl	Calf confidence	Collaboration: Help provider	Mixed	
2	Sen-confidence	Competence: Less competent	Non-affiliation	

Figure 7.3. Portrayal of links among key identity-related levels/factors, situational roles, and identification modes for Whitney.

The portrayal shows that Whitney identified with discourse across all four modes with a fairly even distribution of affiliative and non-affiliative identification modes, thus characterizing her identification as "mixed affiliative/non-affiliative". These modes were connected to classroom-level roles of help-receiver and help-provider, equal and lower competence, and equal and lower vocality relative to counterparts. With respect to identity-related factors, Whitney made numerous connections across sociocategorical and intrapersonal levels, but almost none at the external-community or school/classroom levels. Several key themes of Whitney's identification are reflected in the chart. Whitney's invocations of identity-related factors occurred predominantly at the macro-level and micro-level, and far less at the meso-level.

Social categories. At the macro-level, Whitney's African-American identity intersected prominently with her discursive roles and identification. In situations when she was working with other African-American students, she connected a shared African-American identity to her taking up of—and affiliation with—discursive roles related to help, competence, and vocality. In these situations, she constructed the roles as productive and aligned with her own goals in discourse, and made explicit connections to her African-American identity in doing so. Also at the sociocategorical level, the chart indicates Whitney's non-affiliation with the role of being less vocal, where Whitney again invoked her African-American identity as salient to her taking up a less vocal role, and to her non-affiliation with the role. These instances occurred primarily in the context of her working with non-African American students.

To set up subsequent discussion further on in this chapter and in Chapter VIII, I highlight two particular aspects of Whitney's subcase in framing the intersections between Whitney's identity at the sociocategorical and her classroom-level identification and positioning in discourse. First, Whitney's invocation of race and her African American identity are notably prominent in her accounts of classroom discourse. As we shall see further on, this prominence is absent in the accounts of Griffin, who is also African American. Second, in Whitney's accounts from Interview 1,

she described her African American identity as deeply connected to her family identity, previous academic experiences, and view of herself at an intrapersonal level. Again, we will see by contrast that Griffin did not make such connections. An empirical exploration of *why* this was the case for each of these students is beyond the scope of this study. In Chapter VIII, however, I discuss further questions and inferences related to these phenomena.

Intrapersonal identities. Whitney frequently described a connection between workshop discourse and several intrapersonal ascriptions she consistently made about herself. Overall, she more often associated these self-ascriptions with instances of non-affiliation than affiliation. Whitney most often described herself as empathetic, introverted, and lacking self-confidence. Typically, these ascriptions were associated with non-affiliation in discursive roles where, for example, her empathy would have her imagining another student would not want her help, or her introversion would pit her desire to work alone against the normative obligation to collaborate. There were three notable exceptions to this tendency, however. First, Whitney at times framed her introversion as congruent with vocal collaboration in situations where other students were willing to integrate silent individual work with periodic "checking in". Second, her self-ascribed under-confidence at times intersected with a willingness to provide help to other students as a way to build more confidence. Third, her empathy at times enabled her to intentionally adjust her own position from being perceived as more competent to being perceived as equally competent, as part of her attempt to facilitate more open discourse.

<u>Portrayal summary</u>. Thus at a high level, Whitney's subcase of identification is portrayed as mixed affiliation/non-affiliation with discursive obligations in the workshop. With only a few notable exceptions, her affiliation with discourse is primarily connected to equal-status roles, and non-affiliation is associated with unequal-status roles. At the sociocategorical level, Whitney's

African American identity is instrumental in her explanations of both affiliation and non-affiliation across several roles. She seldom invokes meso-level factors (i.e., external communities, academic identity, classroom factors) in relation to roles and identification modes. Several self-portrayals at the intrapersonal level (i.e., empathy, introversion, and self-confidence) are also instrumental in her explanations, primarily with respect to her non-affiliation across multiple roles.

Subcase B: Griffin

Griffin is a self-identified African-American male student who was in the second semester of his third year at the university during the workshop semester. At the time he was enrolled in the College of Liberal Arts with his major undecided. Griffin began at the university as a chemistry major, but had since considered switching to a major related to computers and was currently in the application process to transfer into the computer engineering program. To complete the program he would need to take a calculus sequence of three courses. He was currently in the first course, Calculus I, for the second time after not having attained the grade of C or better required by his major.

This semester was Griffin's first time enrolling in an ESP workshop, which he heard about from the calculus professor during the first lecture of the term. The professor recommended the course to any students who thought they could benefit from some additional support. Griffin reflected that his struggles the first time he took Calculus I were due to his difficulties completing homework. He estimated that his test and quiz scores had averaged to a C or better, but his homework brought his grade down significantly. He typically tried to complete the homework on his own, but would give up after struggling with the first problem or two, unable to find any resources on the Internet to help. He decided to enroll in the ESP workshop after hearing the professor's announcement. As of a point about a third of the way into the semester (the time of the phase-1 interview), Griffin was finding the workshop to be worthwhile, guaranteeing a substantial amount of time each week to work on problems collaboratively with peers and the instructor in a more engaging way than in the regular TA section. Griffin cited the two-hour length as a critical factor in the benefit he thought it provided. Where in the TA section things felt rushed to "get through" all the material in the 50-minute sessions, the workshop provided enough time to ask questions and work through difficulties with particular problems. Griffin did not perceive enrollment in the workshop as the stigma of a "struggling student". Rather, he characterized students who enrolled in the course as smart for "guaranteeing that they'll spend the time they need" to do well in calculus.

As with Whitney, Griffin's responses during the phase-1 interview revealed several aspects of his identity that were salient to his broader narrative about his life inside and outside of academics. A particular set of aspects from his phase-1 interview are highlighted here based on connections to the modes of identification he described in the phase-2 interview.

Intrapersonal identity

Griffin did not often articulate reflections about himself at the intrapersonal level. He seldom referred to himself as a particular type of person, and rarely highlighted patterns in his way of interacting with others within or across social contexts. One notable exception occurred when he began to describe himself as a person who gets a lot of satisfaction out of learning new things, although this brief foray into self-characterization was offered reluctantly.

286-8 Griffin: ... from YouTube videos I was like able to learn how to take the tile up and put the mortar...down and then you put the tile, level it, and then grout it. and now we can take showers again. so I just feel like independence and learning how to do things yourself is like, beneficial. even later on in life where you don't have to rely on people.

289	TS:	what was the best thing about finishing that tiling job for you? the best part of
		it?
290	Griffin:	like, I completed something new. I never knew how to do it, but just from
		looking from YouTube videos and things I learned how to do it.
291	TS:	I know some people get a lot of satisfaction from just getting a job done, but it sounds like for you it had more to do with, "I figured out how to do this and I
		did it"?
292	Griffin:	yeah. I felt more satisfied. I'm able to do it by myself and basically if you put some effort forward towards anything you're able to do it.

As will become evident later in the case, Griffin's expressed felt need to learn new things arose in his narrations about his academic and mathematics identities, and intersected explicitly with his modes of identification in the ESP workshop.

Academic and mathematics identities

Griffin described himself as a good student through elementary school and high school. He attended his neighborhood public elementary school, and recounted a memory from fifth grade when he performed so well on the state mathematics achievement test that his teacher asked him to take a version of the ACT exam with several other students. This was a key moment when he began to see himself as good at mathematics, though he also expressed that he only thought he could do well if he worked hard at it. He attended a public, selective-enrollment high school and described generally having success in honors-level courses, with periodic struggles in a few of the courses that "most students thought were especially difficult."

Griffin ascribed a high level of importance to mathematics and doing well in mathematics. When pressed, he had some difficulty articulating specifically what was important about mathematics in life or in the world. With certainty, however, he identified the direct impact that his performance in mathematics would have on his ability to attain a degree in computer engineering, and ultimately carry out his functions as a computer engineer, though he was not able to articulate specifically what role mathematics played in computer engineering.

Although he was still confident in his ability to succeed academically at the time of the phase-1 interview, Griffin expressed some concerns about his current academic state and the future of his studies at the university. He was disheartened about changing majors during his third year because of how far he was falling behind in the required course sequences. He also described feeling caught between the urgency to figure out his future and the uncertainty he was facing about what he wanted to do. He mused about going back to school another five years after graduation to earn a degree in something that he really wanted to do, after he had more time to figure out what that was, and more time to earn money for tuition.

Community-level and sociocategorical identities

Griffin grew up in a primarily white and Latinx neighborhood in the city, in a busy, single-family home with his mother, father, and five siblings of which he was the second youngest. His father was an immigrant from Belize and his mother African American. Both of his parents were postal workers. Though Griffin suggested that money was always a concern in the family, they lived comfortably and were easily able to make ends meet. The college tuition policy in the household, for example, was such that Griffin's parents would pay for their children's tuition as long as they were able to maintain a B-average or better. Otherwise, they would have to pay tuition themselves, which was precisely the case for Griffin during this particular semester.

Griffin described being close to both his immediate and extended families, many of whom lived nearby, to the point where he was less inclined to develop deep or lasting friendships at school, in the neighborhood, or elsewhere outside of the family. Griffin explained that there was always a great deal of joking around in his family, and that he found his family was usually more fun to be around than just about anyone else. In particular, Griffin was very close to two of his brothers, staying in frequent contact with them even though they no longer lived in the house with himself and his parents. He described these brothers as his best friends. He largely attributed his tight family connection to his lack of participation in other communities, sharing that he was currently not affiliated with any campus clubs or organizations, and essentially limited his affairs on campus to attending classes, taking care of administrative needs, and independent use of campus facilities such as computer labs, the media center, and the library.

Outside of his family community, one of Griffin's main social communities was found in an online, interactive gaming site in which he participated in tournaments and spent much of his free time competing with other players, some of whom he encountered regularly but most of whom he encountered only for a single game. His passion for the online gaming world, in part, fueled his decision to transfer into computer engineering, though he was uncertain whether the offered course of study at the university would ultimately align with his desire to get involved in game development professionally. He also associated his passion for gaming with his desire to learn new things, and enjoyed the explicit rewards of the points, status, and player rankings available through online games.

At the sociocategorical level, Griffin identified himself as African American, though perhaps more in strictly categorical terms than culturally or politically. Griffin shared that his family constituted his primary social network, and that he did not have many African American friends outside of his family. Throughout his schooling, he was generally one of the only African American students in his classes, which were typically taught by white teachers. He did not recall experiences

in which he believed he was perceived or treated differently by teachers or other students because of

race, nor did he express a need to prove himself because of others' stereotypes.

- 301 TS: how about through high school or on campus here. like at [your high school], let's say- was it- did you have any particular connection with say, other African American students on campus-
- 302 Griffin: no but that's ((unintelligible)) at [my high school] because there's not a lot of African Americans in that school. and then most of them that were there- I remember I was in the alpha [honors] program, so it's like you were in the same classes with the same people, so you weren't actually able to meet new people unless you took like, extra-curricular activities after school. and to meet new people. and even in those classes- I mean in those activities there wouldn't be a lot of African Americans at that school so-
- 303 TS: so, turn that on the flipside then. was that something that-
- 304 Griffin: and I didn't mind anyway either. I didn't really care because I would just make friends with other people. so it isn't like I needed to make friends with people my own race. that doesn't bother me at all.
- 305 TS: and not having a lot of other students of your own race, that wasn't something that you felt like-
- 306 Griffin: I need to do? no, because I have more than enough family to talk to. that's what with friends, like, I don't feel like I have to be forced to make friends or anything. because I have five siblings and I have so many cousins that I could just basically talk to them about anything. so they're like my closest friends-

Although Griffin's responses may be interpreted as ambivalence toward issues of race, in turn

306, he seemed to hint at the possibility that he had faced racialized experiences, but that his family

provided the outlet and support he needed in that respect. He did not elaborate on whether, when,

and how those conversations might have arisen with his siblings, but he did recall explicit

conversations with his parents related to race.

318 Griffin:	[my parents] would just like say- they wouldn't say, like, be careful of this.
	they might just say you have to make sure you do well in classes because, um,
	I don't know- they would say like, since you're African American you have to
	make sure you're good at things. because if you were- okay, compared to a
	white person, if you're average and he's average, the chances are he's going to
	get chosen over you. so you have to make sure you're above average, or-like
	the chances of you're- you know what I'm saying (hh)?
319 TS:	like, you've got to work extra hard to-
320 Griffin:	yeah.
321 TS:	to sort of prove yourself against the stereotypes-

322 Griffin: the competition.

In this passage, Griffin's recall of his parents' conversation establishes the focus of their advice on competition rather than stereotyping. The message Griffin received from his parents reflected the impact of race on opportunity, and focused less on the social or emotional consequences of racialized experiences. Griffin makes this distinction clear in turn 322, rejecting my summation that his parents' advice was specifically about disproving stereotypes, instead casting it instead as being about elevating performance to stand above the competition.

Griffin's modes of identification and discursive roles in the workshop

Similar to Whitney, Griffin identified with discourse in the ESP workshop in a range of modes as indicated in Table X (Chapter VI), describing 17 discursive instances of affiliation, 4 instances of compliance, 3 instances of avoidance, and 1 instance of resistance. Clustering these instances into affiliative and non-affiliative categories, Griffin described affiliation with 17 of 25 (68%) recounted instances of discourse, and non-affiliation with 8 of 25 instances (32%) recounted instances of discourse. Relative to other participants in the classroom, this represents a fairly even distribution of affiliation to non-affiliation. In Chapter VI, I categorized Griffin as "mixed" with respect to his modes of identification. By comparison, Whitney and Griffin's portrayals of identification modes were similar, although Griffin described about half the number of instances of non-affiliation as Whitney. Analysis of Interview 2 shows that Griffin primarily described role/positions related to *vocality, collaboration*, and *friendship*. In this analysis of Griffin's subcase I again explore patterns that serve to explain when and why he identified with particular roles in the ways he did, and why he took up these particular roles in discourse.

Griffin and vocality

With respect to vocality, Griffin described instances in which he was equally vocal in discourse, and others in which he saw himself as the more vocal participant. Consistent with the pattern of equipositional roles, Griffin invariably affiliated with discursive instances in which he described himself as equally vocal. Referring specifically to an instance of discourse with Whitney, he summarized his affiliation by reflecting, "...if you actually have a team that understands what's going on in the class and they're talking about it, then it helps a lot." Griffin sees himself as willing to speak aloud in group work, and seeks the same willingness in others he works with. In several instances he highlighted this as a necessary component to worthwhile group work. It is important to note that while he valued the *willingness* to be vocal, the actual *quantity* of vocal contribution was less important. Griffin, for instance, described situations where he and Whitney would silently work in parallel, and he talked about such instances in affiliative terms because they were both willing to freely check in with each other, share ideas and questions, and respond to those ideas and questions when those interactive moments arose. Griffin's affiliation with small-group work (Discursive Obligation D1) with Whitney aligns with Whitney's affiliation with small-group work with Griffin. That is, Griffin and Whitney both affiliate with their mutually equivocal positioning when they work together, but in a specific mode in which they move flexibly and responsively between silent work and verbal discourse.

Griffin contrasted these affiliative instances with other instances of unequal vocality where other participants did not demonstrate this willingness, as with this recounted instance of working with Justin.

82 Griffin: ... I would always try to talk. I would always try to be the first one who talks, and see if the other people started talking. because that's what I did when I was in Justin's group. I tried to keep talking to him, but then I would only get like one-answer replies. so it was like, you can't keep the conversation going yourself. you sort of seem like an annoying person. so (hh) I just stopped talking, and just did the work.

In this instance, Griffin's description initially implied compliance. He clearly described an effort to engage with Justin, although in a previous turn he framed this effort as an obligation to the instructor in response to the instructor's prompt to work together on problems. By the end of the turn, however, Griffin has moved toward resistance based on his response to how the discursive encounter played out with Justin. In working with Justin, Griffin did not encounter the willingness that he spoke of as being so important in the equivocal instances with Whitney, and he ultimately closed himself off to attempts at further discourse with Justin because of the disequilibrium between their approaches with respect to vocality. This lack of willingness was prevalent with other discursive partners as well, including similar instances involving Vik and Ajay, with whom Griffin similarly approached initially with a sense of compliance that turned toward resistance.

In the context of whole-class discussion (Discursive Obligation D3), Griffin's accounts related to vocality display a pattern of his sense of obligation to "jump start" discourse as an obligation to the class and the instructor at the classroom level, and perhaps his parents at the community level. In the excerpt below from Interview 2, Griffin offered a generalized account of how and why he tends to be more vocal than others in the class during whole-class discussion.

04 Griffin:	this is a class, so I can't just sit there doing nothing.
105 TS:	you could.
06 Griffin:	yeah, but that would be kind of disrespectful, so. I don't want to do that, so.
107 TS:	disrespectful. disrespectful to whom?
08 Griffin:	um, Philippe. is that how you pronounce his name, Philippe? (hh)
115 TS:	would you say that has a lot to do with your contributing? this idea of being respectful?
16 Griffin:	oh yeah. so sometimes I just participate so the class- like so the class continues because like if no one says anything and we're just sitting there, and they like- he asks a question, why wouldn't I answer it? so the class could go on instead of just sitting there. and he like, will linger on a question for a minute. and I'm talking about simple questions. not like something

complicated. like what is the derivative of this? and then I'll just kind of like shout it out.

Here Griffin indicates compliance with the obligation to contribute to whole-class discussion, framing it as an obligation to the instructor borne out of a sense of respect for both the instructor and the workshop community as a whole. When probed further, Griffin makes a connection to his family identity and value system instilled by his parents.

133 TS: but this idea of being respectful to Philippe... why is that important to you?
134 Griffin: ((laughs)) I think I've heard that from my parents, like there are certain people you are supposed to be respectful to, like the doctor, people who are like just trying to teach you something. they're just trying to help you out. why are you going to be disrespectful to them when they're trying to help you out? mmhmm. so like a doctor, your elders, teachers.

The rationale for this learned respect of the instructor is not connected to traditional norms of professional status, but rather is based on the altruistic aspect of the instructor's role as someone who is "trying to help you out," another value espoused by Griffin's parents throughout his upbringing. In this case, Griffin makes a direct connection between his family identity, which has influenced his constructing himself as a person who values respect and altruism, and his compliance with the obligation to contribute. As Griffin continues to reflect on his rationale, he made another connection, also related to his family identity. Recalling that Griffin was responsible for paying his own tuition this semester because of his parents' B-average-or-better policy, he describes how this economic reality influences his approach to vocality.

175 Griffin: okay, so I have to pay for the class and you're paying for the class to get a grade. so to get that grade you should be learning the material that the teacher or professor is giving to you. so if you're not into it, like contributing, you're kind of wasting your money. because you're not learning the material you paid for. so it's like you're basically paying for- you go to school to learn. so, ((laughs)) well you know what I'm saying, like you're paying to learn information, so if you're not ready to get into it that means you're wasting money taking the class to begin with, because you're losing money as the information passes you by.

Here, Griffin interpreted his role of "more vocal" as an investment in making the most out of the class, ultimately to get the most for his tuition money. In doing so, he exercised a level of agency toward keeping discussions going on behalf of the classroom community, but the obligation has shifted toward an obligation to himself, introducing a shift toward affiliation from mere compliance. This shift demonstrates Griffin constructing his identification with this instance through the narrating event in the interview itself, framing a single instance of discourse in both compliant and affiliative modes through his unfolding narrative about why he participated in the way he did.

Griffin and collaboration

Griffin described himself in a number of roles related to collaboration: as help provider, help receiver, mutual collaborator, and verifier/corrector. With all of these roles, his identification was characterized consistently as affiliative. Griffin only ascribed the role of help provider to himself when he was working with a particular subset of students—typically Vik or Justin, and at times Ajay. With these students, Griffin at times assessed that they did not understand concepts or a solution to a problem and provided help as an obligation both to his classmates, and to affirming his own sense of helpfulness.

367 Griffin: I noticed sometimes like when I work with Vik, he wouldn't understand so I would explain it to him. and then after I explained it to him, he understood so, I actually felt helpful. but then with Whitney, most of the time she actually knows how to do it so, she doesn't really need help solving it. so we'll just have an answer and then we'll discuss how we did it.

Griffin affiliates with this role while working with Vik, recognizing the benefit to himself of having "felt helpful." Griffin's taking up the role of help provider, however, is explicitly situational in that he does not do so with students whom he perceives are not in need of his help. When in the role of

help receiver, Griffin's identification mode was somewhat more pronounced and complex. Griffin felt comfortable in this role, but only when receiving help from the instructor or Whitney, as illustrated in the following excerpt from Interview 2.

76 Griffin:	I like the group I am in now because Whitney, she- I know she knows a lot
	of math and she's good at it, so if I ever have a question I could basically ask
	her and she'll give me an answer on how to solve it or what she did to solve it.
77 TS:	okay.
78 Griffin:	and then I'll understand what's going on.

Looking across his instances related to help during small group work, Griffin consistently reported providing help to certain students and not others, and receiving help from only one student, Whitney. It may be the case that Griffin was assigning roles for himself in discourse based largely on with whom he was working, and that those roles had become essentially fixed by the time he reflected on them during Interview 2. An exception occurred with Whitney. The roles Griffin took up in collaborative discourse with Whitney were not confined to receiving help. He also described multiple instances of mutual collaboration and mutual verification of answers, although he never went so far as to explicitly describe himself as *providing* help to Whitney. From Griffin's accounts, his and Whitney's classroom relationship was a highly collaborative one that fluctuated between being truly equipositional and at times taking on a more authoritative stance with Whitney corcupying the higher status position. This status differentiation was, however, periodically contested by Griffin in his bid to recast interactions as more equipositional than he thought Whitney perceived them, as was exemplified in Griffin's account of a collaborative role as verifier/corrector with Whitney:

33 Griffin:	I think I was just kind of checking both of our answers. I think she thinks she got the right answer, and I was trying to see how mine was-like trying to just
	compare them.
34 TS:	okay. so you were kind of looking alongside Whitney?
35 Griffin:	yeah.

In contrast to Whitney's account of her collaboration with Griffin described in the previous section, it is noteworthy that Griffin did not make any connection to their shared African American identity in his reflections on their highly collaborative relationship in the workshop, even in response to my own explicit follow-up prompts in this regard. This is, in a sense, consistent with Griffin's narrative from Interview 1, in which he did not describe any racialized experiences in any of his previous academic settings, and recounted few connections to any African American community outside of his own family. Relatedly, he made no references to his earlier reflections in Interview 1 about needing to perform at a higher level to be able to compete as an African American within the workshop context, again despite targeted prompts.

In the context of presenting his work at the board (Discursive Obligation D2), Griffin again described affiliation when in the role of help receiver, whether the help is provided by the instructor, Philippe, or by the class collectively. Griffin attributed his affiliation in part to the classroom-level convention of having enough time—two hours per class session—to discuss difficulties and ask questions of the instructor without feeling like he would be holding the instructor up from getting through all the material if he asked too many questions (as he would in the 50-minute TA section). In addition, Griffin makes connections between his level of affiliation with this form of discourse and the small class size in the ESP workshop, as well as the safe and comfortable environment he experiences when presenting his work to the whole class.

138 Griffin: that's why I kind of like our workshop. it's so small. you kind of start getting to know everybody in there. so you start getting comfortable around them. so even if you get the problem wrong you know somebody there is going to actually help you and try to correct you. but not in like a mean or negative way. it's like almost- I don't know, they'll just help you to solve the problem. so you don't mind getting it wrong if you're- and you're comfortable.

In Griffin's view, a norm has been established about how feedback should be provided in the wholegroup presentation setting. Griffin recognizes this norm and the high degree to which the classroom community maintains it, with the only exception being, in his words from a subsequent turn, "a few people who have smart mouths once in a while."

Griffin and friendship

With respect to positions related to friendship, Griffin described taking on a role of co-socializer in several instances, and indicated affiliation with these instances. In his view, developing some level of rapport is important to being able to work together on mathematics problems, which is an interpretation of Discursive Obligation 5 (offline interaction) that is consistent with the consensus understanding of the obligation across participants. That is, non-mathematical, social interaction is not only tolerated in the community, but a normative form of discourse that the instructor and students understand as serving a broader purpose in the workshop.

84	Griffin:	well I remember one day we just basically had a day where we could talk, and we kind of connected with the other students in the class and that kind of
		makes you feel more comfortable around them. because you know
		everybody's kind of open to you.
85	TS:	so are you- are you friends with Ajay outside of class time at all?
86	Griffin:	no. I'm friends with nobody in this class outside of class time-
87	TS:	okay. who would you say you're friends with <i>during</i> class?
88	Griffin:	everyone. ((smiles, laughs, then shakes head)) no, no, not everybody.
		probably- the only person I never really actually talked to one on one in that
		class is, I forget her name, Kaytlin?
89	TS:	Yes, Kaytlin?

Griffin has notably fulfilled this obligation with everyone in the workshop except for Kaytlin, a white female student. Griffin's account here reinforces his understanding of the obligation and its purpose. He has not made a social connection with Kaytlin (further evidenced by his difficulty remembering her name). Perhaps not coincidentally, throughout my observations in the workshop,

Griffin never collaborated with Kaytlin despite being midway through the semester in a class of only nine students. There is no explanation from Griffin for their lack of interaction so the reasons for this are unclear, but this account is consistent with Griffin's understanding that without some purely social connection, productive mathematical collaboration may not be possible; and although Griffin did not see his role of co-socializer as extending into friendships outside of the confines of the workshop, he clearly viewed the role as important to fulfilling particular obligations in the classroom. A few turns later, for example, he makes an explicit connection between developing social connections and his affiliation with presenting solutions at the board (Discursive Obligation 2).

Griffin: ...you talk to them and you kind of understand their personality. and as long as you're not a stuck up person, then when you go up to the board to write a problem or just talk to them, you don't feel like you have to hold anything back. like you just could talk to them without worries about them maybe saying like, what is this loser talking about or whatever ((laughs))

Through this account, Griffin's identification with board work presentation is in part traceable to a classroom-level structure designed to build rapport and create open channels for productive mathematical discourse.

Subcase summary: Griffin

Figure 7.4 represents a portrayal of Griffin's identification with ESP discourse in relation to the emergent theoretical model of the study. To provide a point of reference, I summarize Griffin's portrayal in relation to Whitney's. Like Whitney, Griffin identified with discourse in both affiliative and non-affiliative modes. By comparison, however, Griffin's distribution of identification modes was considerably more affiliative than Whitney's. With respect to positioning, he described himself consistently in roles of equal and higher status.

	Identity-Related Factor	Discursive Roles in ESP Workshop	Identification Mode	
ΞL	SOCIAL CATEGORIES:			
LEV	Economic status	Vocality: More vocal	Affiliation	
> MACRO I	EXTERNAL COMMUNITIES:			
	Family identity	Vocality: More vocal	Non-affiliation	
	ACADEMIC/DISCIPLINARY IDENTITY: Few or no direct connections to ESP discourse			
	CLASSROOM LEVEL (Non-positioning factors): Few or no direct connections to ESP discourse			
v.	Classroom structures	Collaboration: Help receiver	Affiliation	
VEI	Classioon structures	Friendship: Co-socializer	Anniation	
IO LE	INTRAPERSONAL IDENTITIES:			
IICF	Altruism	Collaboration: Help provider	Affiliation	
≥	Respectfulness	Vocality: More vocal	Non-affiliation	

Figure 7.4. Portrayal of links among key identity-related levels/factors, situational roles, and identification modes for Griffin.

This pattern was also in contrast to Whitney who tended to describe herself primarily in equaland lower-status roles. With respect to identity-related factors, Griffin made connections more broadly across sociocategorical, community, classroom, and intrapersonal levels compared to Whitney, whose references to identity-related factors were focused almost exclusively at only two levels: sociocategorical and intrapersonal.

Griffin drew substantially from themes in his identity narratives in Interview 1 to explain his identification with workshop discourse in Interview 2. Most of the major identity-related themes he raised in Interview 1 were described as salient in his explanations about workshop discourse in Interview 2. That is, Griffin easily and frequently invoked identity-related factors across various levels in his sense making about his own discourse participation. However, although he made identity-related connections more broadly across levels than did Whitney, I interpret them as lacking

the same weight of influence on his modes of identification compared to Whitney's. Griffin generally associated identity-related factors with affiliation, with a few exceptions he associated with compliance. In either case, he consistently described these factors as drawing him more deeply into participation, rather than away from participation in modes of avoidance or resistance.

Several other summative themes are evident from Griffin's subcase as well. In relation to the influence of macro-level factors, Griffin invoked his family's working-class status as salient to his participation in workshop discourse, primarily in its connection to his responsibility to pay his own tuition as a motive to speak up in order to get the most out of the workshop sessions. As one of only three African American students in the workshop, however, it is notable that at the sociocategorical level he did not invoke his African American identity as meaningful to his identification with workshop discourse. This lack of influence of concerns about race is a conspicuous contrast to Whitney's subcase, in which she explicitly and frequently invoked hers and Griffin's shared African American identity as salient to her affiliation with discursive instances involving Griffin.

Also unlike Whitney, Griffin made direct connections between ESP discourse and several mesolevel factors. His family identity, for example, contributed to his compliance in making vocal contributions to keep whole-class discussions moving in situations where other students would not. Griffin described this as an act of respect for the instructor, done to carry out a family norm of "helping those whose job it is to help you." Also at the meso-level, Griffin described classroom structures of additional time and a focus on building friendly relationships as meaningful to his affiliation with discourse.

At the intrapersonal level, Griffin's self-ascriptions as an altruistic person and as one who shows respect were connected to his identification with discourse. While some participants reported avoiding roles of helpfulness because of confidence issues or because they did not see it as directly

benefitting their own learning, Griffin took up opportunities to help other students as an ongoing construction of his altruistic identity. Similarly, he often described contributing to discussions as something he did out of respect for the instructor and the classroom community, and in doing so further constructed his identity as an altruistic person.

Subcase C: Kaytlin

Kaytlin is a white, female student who was in her first year enrolled at the university, commuting an hour each way between campus near the center of the city and her apartment in an outer-ring suburb. She was a few years older than most workshop students, having attended a community college for three years before deciding to transfer to the university. In part, the transfer was based on her decision to switch majors from culinary arts to earth science. Tracing back to an early childhood interest in fossils and dinosaurs that grew during her formative years, Kaytlin planned to continue on in graduate school toward an advanced degree in paleontology, hoping to eventually work in a museum, conduct academic research, or do fieldwork.

As a requirement of her earth science major, Kaytlin needed to complete two courses in introductory calculus at the university. This semester was her first time enrolling in Calculus I. Before the beginning of the semester she recalled feeling concerned that she might have some difficulties with the course because, having placed out of the mathematics requirements at the community college she attended, she hadn't taken any mathematics courses since high school over three years ago. She also worked full time at an electronics store in addition to her full load of classes, and was anxious about not having enough time to study for challenging courses like calculus. When she received an email (she did not recall from whom) about the ESP workshop, she

enrolled immediately, figuring at the very least it would put some structured time into her schedule to work on the material.

A few weeks into the semester, she found that the calculus course was every bit as challenging as she had expected, and by far the most difficult course she had taken in college so far. She also believed she was doing well—probably better than she had expected—and she attributed a good part of her success to the ESP workshop. She particularly enjoyed the relaxed learning environment of the workshop, the helpfulness of the instructor, and the two-hour block of time that helped them take a deliberate pace with the problem sets. All of these attributes she spoke of in contrast to the calculus lecture and discussion section, which she found far less instrumental to her growing ability to solve problems and understand calculus. In particular, Kaytlin was growing to appreciate the collaborative feel of the workshop, and the teamwork that was emerging among the small group of students with whom she typically worked. While she described an abstract sense that there might be some stigma associated with enrolling in the workshop because it "shows you can't succeed on your own," Kaytlin easily dismissed the notion because of the success she was experiencing.

As with Whitney and Griffin, Kaytlin's responses during Interview 1 focused on several key aspects of her identity at intrapersonal, school and classroom, community, and sociocategorical levels. Themes from Interview 1 are highlighted here that are revealed to be salient in connection to the modes of identification she describes in Interview 2.

Intrapersonal level

Kaytlin portrayed herself in two primary ways at an intrapersonal level: as highly motivated and as persistently competitive. Her self-perception as a motivated person spanned communities and contexts, as illustrated in the following excerpt from Interview 1.

174 Kaytlin: um, like I guess academically I work harder- like I guess I have to work harder at work. I have to do my job well. I put a hundred percent into everything that I do. and so, when I'm at school I put a hundred percent in at school, when I'm at work I put a hundred percent in at work. and sometimes I feel like there's no in between. I'm just switching from work to school work to school. so, it's just non-stop ((laughs))

In part, Kaytlin connects her sense of motivation—of always giving one hundred percent—to the influence of her parents and of her "not wanting to disappoint them" (Interview 1: ##) because of how hard they worked to support her in her schooling and in life. She also draws a connection between her motivation and her economic realities, which necessitate her working full time to put herself through school, and which create extra demands on her that most of her peers do not experience. She extends her sense of "having to do her job well" (Interview 1) at the workplace to a broader intrapersonal identity of motivation that includes academics, as well as simple tasks of day-to-day living and even personal relationships for which she describes herself "putting everything into" (Interview 1) in order to make them work.

Kaytlin's sense of her own competitiveness spans various communities and relationships as well, and is intertwined with her intrapersonal identity as a motivated person. She describes competitiveness in her relationship with her boyfriend, her younger sister, her best friend at the university, her coworkers, and with other students in the ESP workshop. The following excerpt from Interview 2, already discussed in part in Chapter VI, reveals some of the connections Kaytlin makes about the development of this aspect of her identity.

463 Kaytlin: ...in almost everything I strive to be the best, to be number one. I do, I do, I do, I do, I like it.
464 TS: any thoughts about where that comes from?
465 Kostlin: ((icho)) I think it has comething to do with like. I have kind of law self.

465 Kaytlin: ((sighs)) I think it has something to do with, like- I have kind of low self esteem sometimes. I don't' give myself enough credit, so then I try to be the best, and I try to do the best. especially like my job stuff? like I try to do the best that I can and be number one, and that way other people will look up to me and stuff. I like to have other people look up to me, or ask me questions, and, you know.

466	TS:	do you work in- do they call it the geek squad?
467	Kaytlin:	yeah, they call it the geek squad. I work in the cell phone department though.
		mostly yeah. I'm the number one performer in my department.
468	TS:	which means what?
469	Kaytlin:	so I'm the top seller in my department.
470	TS:	and are you conscious of that?
471	Kaytlin:	yep. ((laughs)) I always know where I'm at, where my numbers are.
472	TS:	is that part of the motivation structure? do they make that public?
473	Kaytlin:	no I do it myself. yeah, I actually started like in our department- now
		everybody else is tracking because I did it on my own. so yeah.

In turn 465, Kaytlin connected her competitiveness to a self-ascription of low self-esteem and a desire for others' approval. Notably, this is the only explicit reference she made to low self-esteem across both interviews, while the self-ascription of competitiveness arose often and in multiple contexts. In the interview data, the latter appeared as a more reified aspect of Kaytlin's identity, and was also more salient than self-esteem in her accounts of discourse in the ESP workshop. In turn 471, Kaytlin also revealed her own awareness of her competitiveness as it intersected with the negotiation of her identity in her workplace community. She showed a similar awareness in describing other competitive relationships, generally viewing them in a positive light as in this account of her relationship with her best friend.

307 Kaytlin: I think being friends with her is an investment in my academic life. um, I think she drives me to do better, because I want to beat her. ((laughs)) I mean I guess my performance is important as well, but I know that I wouldn't do nearly as well if I wasn't with her.

While elsewhere she expressed valuing this friendship at a social and emotional level, here it was clear that the competitive aspect was central and meaningful to Kaytlin. This theme carried through to virtually all of the relationships and communities Kaytlin identified as particularly meaningful in her life.

Academic identity

When Kaytlin was five or six years old, her father found a fossil near the firehouse where he worked and brought it home for her. She vividly recalled her excitement about holding something that was millions of years old. She also recalled how passionate her dad seemed about sharing it with her. He had always had a deep interest in science, and he was intentional about sharing that with his children. From the moment he handed her the fossil, a love of science and prehistory began to take root in Kaytlin and ultimately set her on a pathway to majoring in earth science and aspiring toward a graduate degree in paleontology.

The pathway Kaytlin described, however, was not always easy for her. In elementary school, she often found herself an outcast because her classmates found her lingering interest in fossils and dinosaurs childish and "geeky," (Interview 1) and those labels stuck with her all the way through high school. Eventually, she entered community college having abandoned her aspirations toward paleontology to pursue a major in culinary arts. At the urging of her father, as well as of a couple of new college friends who did not know her in high school, she decided to reconnect with her passion and change majors into earth science. Having eventually transferred to the university, she was now enjoying success in her coursework and found most of it—with the exception of calculus—coming relatively easy for her. As the first in her family to attend a four-year college, Kaytlin described some additional pressure to succeed. She sees her academic success in relation to her role as the one to "break the college barrier" (Interview 1) for her family and set a strong example for her seven younger siblings to achieve opportunity through academics as well

Mathematics identity

Kaytlin attributed her challenges with calculus to the demanding nature of the course content and the length of time since her last mathematics course. She described herself as someone who is good at math and who loves math, both of which she attributed to her mother who pushed her to excel by giving her additional practice with math problems throughout elementary school.

78 Kaytlin: ... if I got any problems wrong, like on any homework or any, any test or anything like that, I would come home, and she would look over it. she would also read the book to make sure that she knew like what- what it was about? and then she would sit and explain to me how I did it wrong and how to do it. and then we would do the problem over and over again until I got it. it would sometimes take a couple hours where like she made sure that I got it. ((laughs))

Kaytlin believed this extra pushing and practice helped her see herself as successful in mathematics, and also instilled in her a sense that math was important, and worth sticking with even at times when it did not seem fun. By the time she got to high school, however, she found herself feeling more and more disconnected from mathematics. In her mind she knew she should persist in trying to succeed, but she slowly stopped caring about mathematics as the content became more abstract, and as concerns about how she was being perceived by her classmates began to overshadow her interest in mathematics and science.

It wasn't until her junior year that her step-mom—with whom she had developed a close relationship after her parents divorced and her father remarried—helped her turn her attention back to academics, and mathematics in particular. Her step-mom's support focused less on pushing her to practice, and more on listening, understanding, and counseling her to prioritize long-term academic success and opportunity over the short-term concerns of being liked by her peers. In her last two years of high school, Kaytlin described success in honors mathematics classes that included introductory calculus. The teachers of those courses helped her rediscover the challenge and joy she experienced in mathematics during her earlier years in school. Now in college-level calculus three years since having taken her last mathematics course in high school, she has found a new level of satisfaction from working on challenging mathematics, particularly in the context of the ESP workshop.

128	Kaytlin:	when I work on a problem for a really long time or if I'm not understanding
		something? and then all of a sudden it's like I get it and I get that rush of, I
		don't know, happiness or endorphins or something. I don't know what's going
		on, but it's such a wonderful feeling. it drives me to keep on doing it, cause I'll
		get that feeling again. like, let's, let's work harder, so- I love it. I love it.
129	TS:	okay. so that kind of working hard, clicking, getting it, getting the sort of
		neural reward? would you say that's unique to math?
130	Kaytlin:	I don't think it's unique to math, but I think I get a bigger, like rush, doing
		math than I do anything else. yeah, actually probably, it's specific to math
		actually- yeah.

Here an interplay of identities comes into view between Kaytlin's intrapersonal sense of herself as a motivated person, and the deep satisfaction she experiences from success and persistence, uniquely related to her participation in mathematics.

Community-level and sociocategorical identities

Kaytlin grew up and attended school in a small town just beyond the reach of the suburbs, a place where "everyone knew everyone's business" (Interview 1). She was the eldest of eight children, though when her parents divorced early in her teenage years, half of her siblings moved to another state with her mother, and she with the other half stayed with their father who soon remarried. Kaytlin described herself as being very close to her father, step-mom, and local siblings, while having lost some of the connection with her mother and the siblings who went to live with her. In particular, she described a special relationship with her younger sister, who was 12 years old at the time of the interview and shared many of the same goals, interests, and challenges that Kaytlin

did growing up. An important aspect of Kaytlin's family identity is constructed from the mentoring relationship between the two.

211 Kaytlin: ... she's going into junior high and high school where, like, girls aren't really secure in their mathematics and their sciences. they're- they feel like they have to be, you know, pretty versus being smart- stuff like that. I really want to encourage her and show her that, hey, you can be both. ((laughs)) you know, you don't have to do that. you can do what you love and go into the sciences and be successful in that. like I really want that- that's very important to me for her. cause I don't want her to feel like she can't do something. cause I definitely felt that in high school, that I couldn't- I couldn't be a paleontologist. I couldn't do math. I couldn't do science. but I don't want her to feel like that. ((laughs))

It is evident in Kaytlin's narration of this relationship that her role of mentor was closely intertwined with the construction of her own academic and mathematics identities, particularly in terms of how they intersected with her gender identity and genderized experiences. Kaytlin calls upon all of these aspects of her own identity in the relationship with her sister, and in the process further constructs her own gender-identity narrative at a sociocategorical level.

229 Kaytlin: I mean, I was made fun of a lot when I was in junior high and high school. like, I didn't care about my appearances or anything like that. I wouldn't- girls started doing makeup and stuff, and I was like, I don't really care about that. when I was at a point where people were like making fun of me because I wanted to do science and stuff like that?

Another aspect of Kaytlin's identity that was potentially salient in her workshop participation

was her identity related to her job. Kaytlin took pride in her sales work at the electronics store, but

also extended her identity as "full-time worker" beyond the workplace community and into her

academic life.

168 Kaytlin: I feel like I have to work a lot harder? like, there's a lot of kids here who are able to relax, or like not take a job and stuff like that? I feel like I have to work really hard in order to achieve it. and it's like non-stop.

Not only did she describe having to take on the responsibility of a full-time job that most other

students did not, but also of finding time to fit studies in, and doing so while feeling exhausted after

having worked a full day. Through this account, she invoked her economic status (at the sociocategorical level) as salient to how she perceived her academic performance related to other students—that the "deck was stacked against me" (Interview 1: ##) because she had only half the time and energy to put into her academics compared to most of her peers.

Kaytlin's modes of identification and discursive roles in the workshop

Similar to the Whitney's and Griffin's subcases, Kaytlin identified with discourse in the ESP workshop in a range of modes as indicated in Table X (Chapter VI), describing 10 discursive instances of affiliation, 2 instances of compliance, 2 instances of avoidance, and 3 instances of resistance. Clustering these instances into affiliative and non-affiliative categories, I characterize Kaytlin as "mixed" with respect to modes of identification, affiliating with obligations in 10 of 17 (59%) recounted instances of discourse, and describing non-affiliation with 7 of 17 (41%) recounted instances of discourse.

Analysis of Interview 2 shows that Kaytlin's patterns of identification corresponded almost invariably with the relative status she described during discursive instances. With only a few notable exceptions, she tended to affiliate when in positions of equal status or lower status, and tended *not* to affiliate when in positions of higher status. In the following sections I attempt to explain both of these patterns in connection with Kaytlin's identity narratives from Interview 1. This pattern is different from Whitney's and Griffin's patterns of identification, which were more directly connected to the specific roles they took up rather than the status levels associated with those roles.
Kaytlin in equal- and lower-status roles

Almost invariably, Kaytlin described affiliation with discursive instances in which she was in a position of equal status in discourse, whether it was with respect to competence, vocality, or motivation. This pattern was consistent with the overall pattern in the classroom, where students generally approached equipositional roles with a sense that they allowed for participation in productive and worthwhile discourse. When she took up non-equipositional roles, Kaytlin's pattern of identification followed a different trend whereby she affiliated only when she occupied the lower-status position in discourse.

An example of her affiliation with a lower-status role occurred in the following instance transcribed from a classroom video observation. As Kaytlin was presenting and discussing her solution to a problem involving finding a derivative using the chain rule with the whole class (Discursive Obligation D2), she received help from the instructor and Marco. Her role as helpreceiver in this instance was characterized as lower-status based on the categories established in Chapter VI. After several minutes of back-and-forth discussion about her solution, the following dialog occurs among Kaytlin, Marco, and Philippe (the instructor).

- 247 Kaytlin: darn it. I forgot the negative one half on that side ((points to area of her solution written on the board)) hang on. ((goes back up to the board from her seat. makes correction to her solution.))
- 248 Philippe: oh.
- 249 Marco: so you got the same thing as I did.
- 250 Kaytlin: I got the same thing.
- 251 Philippe: you cancelled- oh, okay.
- 252 Kaytlin: I didn't cancel- I didn't cancel the two to this one. (crosses out cancelled terms from her original solution))
- 253 Philippe: so if you cancelled out the numbers, you got it.
- 254 Kaytlin: I did? I did! yes! (does fist pump, puts down chalk, returns to seat smiling) oh man, I'm so excited.

After viewing a video clip of this classroom instance during Interview 2, Kaytlin reflected on the instance with a similarly positive reaction to what she demonstrated in the video, responding to a follow-up question as follows:

263 TS: ...what was most important to you in that moment? 264 Kaytlin: I like the fact that everybody collaborates and we actually get together and figure it out. even if I didn't get it right the first time, like seeing- like having other people come in and showing me how to do it right? kind of helps too. I don't know, I liked that. that was a good day. I liked that problem.

Her response in turn 264 indicated affiliation with her role of "help receiver" in this instance. Kaytlin's description of this instance illustrates a broader pattern in which she described affiliation with discourse in which she occupies a lower-status position (e.g., help receiver, less competent). The pattern raises the question of why Kaytlin affiliated as consistently as she did with lower-status and equal-status roles. To address this question I looked again to connections Kaytlin made to salient identity-related factors. At the intrapersonal level, she frequently invoked her self-portrayal as a competitive person in describing her affiliation with lower-status roles. One such instance occurred during collaborative problem-solving with Marco and Sam (Discursive Obligation D1), when Kaytlin corrected a mistake that Marco had made in incorrectly applying the power rule to a constant term while finding the derivative of a function. Kaytlin reflected on this instance in the following excerpt from Interview 2.

- 457 Kaytlin: (hh) I loved it. I like it when he doesn't know a question. ((laughs)) it makes me feel good. I'm like, yes, I know something he doesn't ((pumping fist)) because he always knows more than me.
 458 TS: do you think that's true?
- 459 Kaytlin: uh, I think in most cases. I kind of feel like he knows it better- the material better. ((crosses arms in front of her)) I don't know, maybe I'm not giving myself enough credit, but- I don't know, he's the one I look to when I have questions. he must know more than me, right? ((laughs))

This particular instance was coded as affiliation, indicated by Kaytlin's indications of engagement and the personal satisfaction she took in her fulfillment of the obligation. The instance was double coded for Kaytlin's role in the discourse, because while she was providing help to Marco in the moment, she also indicated that she was doing so from a position of lower competence. It is evident that her strong affiliation with the instance is tied to this positioning, in that she keenly appreciates the moment *because* she sees Marco as usually being the more competent group member. In this and other instances like it, her competitive self-perception and concerns about how she is perceived by others come into play when in discourse with participants whom she viewed as equally or more competent. Her positioning in these instances provided an opportunity to match or surpass the competence of others where the issue still hung in the balance, thus allowing her to further construct the competitive aspect of her identity at the intrapersonal level. As I will show further on, this phenomenon played out very differently when Kaytlin found herself in positions of higher status.

Because Kaytlin's narrative in Interview 1 contained specific accounts of her gender identity and how gender-related experiences intersected with her mathematics identity, it was notable that she did not raise gender issues as salient to her identification with workshop discourse. This was the case even in instances like that described above in which she worked with two other male students and shared unprompted reflections about competition and relative competence. When specifically prompted about whether and how gender might have come into play while working with Marco and Sam, Kaytlin's reflection minimized the connection.

270 Kaytlin: ...I think sometimes I feel like I'm in competition with them, but I don't think it's gender-related. I think it's because I know they're smart, so I want to be- or I want people to see me as smart as them. or them to see me as equally as smart I guess. um, especially since I struggle usually in the beginning and then I end up getting it at the end. so like, I want them to know that hey, I have valid thoughts as well. I'm not just here, you know? Kaytlin foregoes interpreting her discourse with Marco and Sam at the sociocategorical level (i.e., as related to gender) in lieu of an interpretation at the intrapersonal level, again invoking her identity as "competitor" early in turn 270, and later her concerns about how she is perceived by others. Whether or not her response can be viewed as an invocation of gender identity is a matter of interpretation, particularly in light of her explicit response that it was not. This response is notable by its contrast to how salient gender identity was in her narrative in Interview 1, and this apparent inconsistency will be taken up further in the Discussion chapter.

Kaytlin in higher-status roles

When participating in discourse from a higher-status role, Kaytlin described a pattern of identification in stark contrast to her pattern in equal- and lower-status roles. In instances where she described her role as more vocal, more competent, or more motivated, she tended to either avoid or resist the discursive obligation. In the following instance, for example, she describes working with Whitney in a small group (Discursive Obligation D3), which she contrasts distinctly with working with Marco and Sam.

362 TS: And when you worked with Whitney? Was it the same, or different [as with Marco and Sam]?

363 Kaytlin: I hate to say this, but different. ((laughs)) I think so. I mean, that doesn't mean that she doesn't know what she's doing, but like, she's very quiet, so I kind of feel like she doesn't know what's going on and I don't know really what to do with that? but like, then sometimes she surprises me. there's like some points where it's like, oh I don't know what that is, and then she'll go up to the board and do it. and I'll be like, oh, she does know what's going on. so, I hate to say that, but yeah. ((laughs, unintelligible))

364 TS: ok.

365 Kaytlin: yeah, I mean Marco is very vocal and he's usually right a lot of the time, soand if he's not right then he'll figure it out quickly that he's not right and fix it. you know he always gets it done. but she's very quiet, I don't- it's a little bit different. Kaytlin describes herself here as occupying the more vocal role with Whitney, whom she described as "very quiet." There was an implication of avoidance in turn 363 in Kaytlin's use of the phrase "I don't really know what to do with that," as well as in a subsequent passage where she indicated gravitating toward working with Marco and Sam over Whitney (and others) whenever she had the choice to do so. Yet later in turn 363, Kaytlin recognized Whitney's competence but still did not change her stance of avoidance toward working with Whitney. At least on the surface, Kaytlin's avoidance was connected to the higher-level, more-vocal status she described of herself in her partnership with Whitney. In turn 365, the connection was verified in the direct contrast she drew to working with Marco, whom she viewed as equally vocal, which made the interaction "a little bit different."

A similar pattern emerged with other collaborators as well, as in an instance where Kaytlin described working with Justin.

368	TS:	so here you were working with Justin-
369	Kaytlin:	this was just, no ((shaking head)).
370	TS:	okay, no what?
371	Kaytlin:	((still shaking head)) not working for me. because Justin sleeps all the time.
		((laughs)) like I feel like he doesn't care. or doesn't know what's going on, and
		like I don't- ((shakes head))
372	TS:	has it ever been helpful working with Justin?
373	Kaytlin:	um?
374	TS:	I mean-
375	Kaytlin:	it'd be like oohh. ((clenches fists, looks up, laughs)) why does he know this and I don't? that's what it would be like. he doesn't pay attention. he doesn't work hard. how could he get it? like, what's- like what happened? ((cracking knuckles))

In this instance Kaytlin's description indicates she occupies the role of "more motivated," and does so in a mode of resistance. While non-affiliative identification is common among several participants in their discourse with Justin (see Griffin's subcase, for example), Kaytlin indicates an overt level of resistance where others tend to be more compliant and willing to make the best out of the situation when it arises.

Again, Kaytlin's identity as a competitive person comes into play, this time in connection with her resistance. In her role of being the more motivated partner compared to Justin, Kaytlin describes aversion to the possibility that Justin might be able to provide her with help (turn 375). She would experience the resulting switch in relative status as a competitive loss rather than as useful help or an opportunity to further elevate her own status compared to Justin. As she described further in turn 375, the hypothetical situation would leave her questioning her own competence relative to Justin, particularly in light of his "lower motivation" role in their interaction.

Subcase summary: Kaytlin

The diagram in Figure 7.5 represents the portrayal of Kaytlin's identification with ESP discourse in relation to the theoretical model. As with Whitney and Griffin, Kaytlin identified with discourse in both affiliative and non-affiliative modes, and is therefore characterized as "mixed" with respect to identification. With respect to positioning, Kaytlin described roles related to collaboration, vocality, and motivation. Kaytlin described a consistent pattern between the particular students with whom she participated and her relative status compared with those students. With Marco and Sam, she took on equal- and lower-status roles; with Justin, Ajay, Vik, and Whitney, she took on higherstatus roles. There were also two students with whom she did not interact directly in workshop discourse.

It is noteworthy that Kaytlin only made connections to factors at the intrapersonal level. The lack of connections made at the macro- and meso-levels was conspicuous particularly because Kaytlin's narratives from Interview 1 depicted deeply constructed identities across multiple levels involving

gender, family, workplace community, previous academic and mathematical experiences. Yet these identities and experiences largely did not appear as connected to Kaytlin's participation in workshop discourse in her accounts from Interview 2.

	Identity-Related Factor	Discursive Roles in ESP Workshop	Identification Mode				
IICRO LEVEL <> MACRO LEVEL	SOCIAL CATEGORIES: Few or no direct connections to ESP discourse						
	EXTERNAL COMMUNITIES: Few or no direct connections to ESP discourse						
	ACADEMIC/DISCIPLINARY IDENTITY: Few or no direct connections to ESP discourse						
	CLASSROOM LEVEL (Non-positioning factors): Few or no direct connections to ESP discourse						
	INTRAPERSONAL IDENTITIES:						
		Competence: Equally competent (equal status)					
		Collaboration: Help receiver (lower status)	Affiliation				
	Competitiveness	Collaboration: Help provider (higher status)					
		Vocality: More vocal (higher status)	Non-affiliation				
		Motivation: More motivated (higher status)					
≥	Self-esteem	Competence: Less competent (lower status)	Affiliation				

Figure 7.5. Portrayal of links among key identity-related levels/factors, situational roles, and identification modes for Kaytlin.

By including the status level of each of Kaytlin's discursive roles in the chart in Figure 7.5, a pattern becomes evident where Kaytlin affiliates with discourse in equal- and lower-status roles, and does not affiliate with discourse in higher-status roles. This pattern is explained by considering Kaytlin's intrapersonal-level identities as a "competitive person" and as a person who describes herself as at times suffering from low self-esteem. From lower- and equal-status roles, Kaytlin's construction of herself as a competitive person is brought to bear on her identification with discourse, where discourse is constructed as an opportunity to achieve or surpass the status of those students she sees as either equally or more competent than herself. This pattern was particularly consistent in her collaboration with Marco and Sam. From positions of higher status (when working

with other participants she described as occupying lower-status roles), Kaytlin did not see a need to further reinforce her own higher status, nor to help lower-status students increase their own competence. Doing so might have potentially lowered her own status relative to theirs, and in her words, make her wonder "what's wrong with me?"

Themes Across Subcases

In review of these three subcases, several key themes emerged about discursive roles and identity-related factors. The detailed subcase analyses offered a view of the complexities of identification that were not available in the broader classroom-level analyses described in Chapters V and VI. New themes and patterns came into view by examining the roles and identity-related factors in more detail at the individual student level. In this section I highlight these themes by comparing these subcases to offer further explanations about students' identification with discourse.

Identification and situational roles

Patterns in the three subcases reflected the overall trend in the workshop that students generally affiliated with equipositional roles (see Chapter VI). This was perhaps the most steadfastly consistent pattern in the study, and is grounded in a body of research on power and status related to classroom discourse (Esmonde & Langer-Osuna, 2013). When roles of unequal status were taken up, however, identification became more complex. While it might be presumed that higher-status roles would consistently be associated with affiliation and lower-status roles with non-affiliation, the three subcases depicted a less predictable phenomenon. In unequal-status roles, explanations for identification only came into view by considering the influence of identity-related factors acting at macro-, meso-, and micro-levels, as I will discuss in more detail in the next section.

With respect to how students adopted particular roles in discourse, it is important to recognize that these roles did not merely happen to students, but that they were co-constructed by students and their counterparts in discourse, and that they were reconstructed through their own narration of events in post hoc reflections. As Whitney, Griffin, and Kaytlin participated in workshop discourse, they were seen to have adopted forms of *agency* in co-constructing and interpreting their positions for particular purposes. One such form of agency involved students' intentional selection of partners in the workshop so that they could more easily establish particular roles for themselves, and ultimately to establish more affiliative contexts for discourse. Whitney, for example, found ways over time to situate herself where she would work with Griffin as often as possible (at times despite the instructor's encouragement to work with different people). She described doing this because of their shared African American identity and their similar approaches to collaborative work, both of which created for her a discursive space that was productive to her mathematical and intrapersonal goals. Similarly, Kaytlin described "staking out" physical locations in the classroom that would ensure her partnership with Marco and Sam, and guarantee that she would not be paired with students she positioned as less motivated or less competent than herself.

A different form of agency was evident when participants found ways to shape existing collaborative relationships, again to create more productive discourse for themselves. For example, Whitney described several instances in which she mobilized her sense of empathy toward shaping a more equipositional relationship with a workshop partner. She did so by portraying herself as equally competent to her partners, even though internally she viewed her position as being more competent. In doing so, she created a discursive space that was more comfortable for her, more comfortable for her peers, and therefore more likely to elicit helpful contributions from her peers. Similarly, Griffin described engaging in off-task, purely social interactions to establish a safer and

more comfortable context for collaborative problem-solving. These forms of agency demonstrate that, while discursive roles among workshop participants were at times relatively stable over time, participants also acted with agency in shaping their own discursive contexts in ways that supported more positive identification.

Themes of identity-related factors

It was established in Chapter VI that classroom-level positioning—operationalized in the particular, situational roles students described for themselves in workshop discourse—represented a primary factor in the workshop students' identification patterns. This "primacy of positioning" was hinted at by the comparatively high code frequencies related to classroom-level roles and positions, and merited a focused analysis on patterns between students' positioning and identification. But students also indicated that identity-related factors other than classroom-level positioning influenced their workshop discourse as well. The influence of these factors came into clearer view in the detailed subcase analyses of Whitney, Griffin, and Kaytlin. Looking across these three individual subcases, some notable patterns (and also "non-patterns") appeared with respect to factors at various levels.

Intrapersonal-level factors. From the portrayals of each subcase summary (Figure 7.3, Figure 7.4, and Figure 7.5), it was conspicuous that Whitney, Griffin, and Kaytlin all described intrapersonallevel factors as salient in their accounts of discourse. Each of these students had recurring, relatively stable ways of constructing themselves in social interaction across social contexts, both inside and outside of the workshop. In Whitney's case, she constructed herself as empathetic, under-confident, and introverted; Griffin as altruistic and respectful; and Kaytlin as competitive and at times having low self-esteem. For each of these students, these intrapersonal-level factors were a common thread

of influence in the roles they adopted and their modes of identification. On balance across these students, intrapersonal-level factors were perhaps the most consistently invoked after classroomlevel positioning. This might be explained by the relative stability that intrapersonal-level identities tend to exhibit across one's multiple communities of practice (Wenger, 1998). For example, when Whitney describes herself as "introverted," this construction of herself was more durable across contexts and communities than her self-descriptions as a particular type of student, which were more variable and situational depending on the particular classroom community.

Yet, these relatively stable intrapersonal identities were also at times renegotiated within workshop discourse, even if this was done against substantial inertia. In Whitney's account of "faking it to make it," for example, discourse became an opportunity to reconstruct her underconfident identity as she pushed herself to take on a more confident, competent, and helpful identity with her peers. Kaytlin similarly at times described a renegotiation of her competitive identity during instances when she found herself in the role of help-provider.

<u>Meso-level and micro-level factors</u>. Meso-level factors such as external communities (e.g., family, workplace), and academic/disciplinary identities; and micro-level classroom factors other than positioning (e.g., classroom structures) were situational and individualized with respect to their influence on these students' identification modes. With Whitney and Kaytlin, meso-level and micro-level factors were seldom raised in connection with workshop discourse. In Griffin's accounts, his family identity in particular intersected with his participation in workshop discourse in meaningful ways. For other students whose subcases were not presented in this chapter, meso-level factors were highly salient. Marco and Vik, for example, described their high school mathematics experiences as influential in the ways they participated in discourse. For Sam, his home-schooling experiences and family identity were salient in his descriptions. As a general tendency, meso-level factors were

consistently associated with affiliation with workshop discourse. This was related to family identities providing students with tools and supports to engage in academic discourse, and with previous academic experiences either directly helping students build affiliation toward collaboration and discourse, or providing contrastive experiences that led them to appreciate the collaborative, discursive features of the workshop.

Social categories. Given the ESP program's designed intention of providing support for underrepresented students in introductory STEM courses, a substantial area of interest in the study was to understand the interplay among sociocategorical identities and workshop discourse. In all three subcases in this chapter, the students referred to at least one sociocategorical aspect of their identity in Interview 1: Whitney to her African American identity, Griffin to his African American identity and socioeconomic status, and Kaytlin to her gender identity. Table 7.1 shows that in some cases these aspects were narrated in Interview 1 as being highly significant in these students' lives, and in other cases not as significant. The subcase analyses then chronicled (primarily from Interview 2) whether and how the students described these aspects as salient in their identification with workshop discourse.

This summative comparison shows that sociocategorical factors may influence these students' identification with classroom-level discourse in meaningful ways, but not predictably. Looking comparatively at Whitney and Griffin's subcases, the sociocategorical factors they described as important in their lives also influenced their workshop discourse, and vice versa. In Whitney's case, she described her African-American identity as a central aspect of her identity, and she also invoked it as a key factor in her participation in classroom-level discourse; though she did not invoke gender as salient. In Griffin's case, he did not describe his African-American identity as particularly influential in his relationships or experiences outside of his family life, nor did he describe it as

meaningful with respect to his participation in workshop discourse. He described his working-class status as an important part of his upbringing and of his identity in general, and also expressed its relevance to how he participated in classroom discourse.

Table 7.1. Sociocategorical Factors and Workshop Discourse					
Participant	Sociocategorical Factor of Marginalization	Described Experiences of Marginalization Outside of Workshop?	Described as a Salient Factor in Workshop Discourse?		
Whitney	African-American identity	Yes	Yes		
winney	Gender	No	No		
Criffin	African-American identity	No	No		
GIIIIII	Socio-economic status	Yes	Yes		
Kaytlin	Gender	Yes	No		
Marco*	Latinx identity	No	No		

* Not included in subcase analysis; little or no descriptions of experiences of marginalization inside or outside of the workshop classroom

But this pattern did not hold with Kaytlin. In Interview 1, she relayed vivid experiences related to her gender identity in connection with previous schooling experiences, family relationships, and social interactions. Yet in her descriptions of instances in the workshop where gender would have appeared to play a role in how discursive roles were constructed to the researcher, Kaytlin dismissed the influence of gender, focusing instead on classroom-level roles occurring independently of higher-level factors. A deeper analysis of why Kaytlin might have sequestered her deeply constructed gender identity from her accounts of workshop discourse is beyond the scope of this analysis, but the phenomenon raises important questions about how identity construction occurs, and is interpreted, at the macro and micro levels. I unpack these questions further in the discussion chapter to follow.

Summary

The subcase analyses were conducted to bring into clearer view the particular ways IRFs factored into the phenomenon of identification with discourse for individual students, with the goals of: 1) providing detailed depictions of how the phenomenon of identification with discourse plays out for three participants, and 2) documenting further the role of IRFs in the overall theoretical model for the study.

The first goal is related to the phenomenological nature of the study, where the intention is to provide rich, descriptive accounts that depict the phenomenon in question. The subcases are specifically intended to evoke the richness of the "human complexities" surfaced and interpreted in the accounts of individual informants involved in the phenomenon (Lichtman, 2006; Denzin & Lincoln, 2008). Running underneath and among the theoretical constructs and categorizations that emerge from the analysis, students' accounts themselves shed light on the phenomenon and allow for students' own individual accounts and interpretations of their experiences to further define, nuance, and problematize students' identification with workshop discourse.

With respect to the second goal, the subcases documented they ways that situational roles interacted with IRFs, and showed how these interactions were salient to these students' descriptions of identification. The theoretical model (see Figure 7.2), in its final iteration for this study, was adjusted to reflect this facet of the relationship represented, where the interaction between situational roles and IRFs is salient to the ways students identify with instances of discourse. Another important finding from the subcases, however, is that the ways that roles and IRFs influence students' modes of identification is highly individualized and situationalized. That is, the IRFs (and corresponding levels) that these three students invoke as salient are highly variable across the three students. While some factors were commonly invoked as salient across all three students—such as those at the

intrapersonal level—this patterns did not hold for most factors, which tended to be salient to one or two, but not all three students. This inconsistency was notably the case for sociocategorical factors, where the three subcase students—all self-identifying as being a member of a marginalized group—invoked (or did not explicitly invoke) sociocategorical factors in highly varied way. This case-study finding invites further discussion and interpretation of the differences among these three students' approaches to the inclusion or exclusion of race, gender, and class issues in their accounts of positioning and identification in moment-to-moment discourse.

CHAPTER VIII. DISCUSSION

Summary of Key Findings

This study aims to advance understanding of why students participate in mathematics classroom discourse in the ways they do, with a focus on explaining the individual differences that are often apparent as students take up (or do not take up) opportunities to engage in mathematics communication in a collaborative setting. I approached this inquiry from a sociocultural perspective, with the intent of documenting how identities enacted by students at various levels (e.g., sociocategorical, community, school, classroom, and intrapersonal) intersect with their identification in the discursive activities in an undergraduate calculus workshop. Specifically, I intended to address these guiding questions in relation to the workshop ecology: 1) how do students describe their *identification* in moment-to-moment instances of discourse? and 2) how are *identity-related factors* invoked in students' explanations of their identification with workshop discourse? My exploration of these questions put together was aimed toward generating a theoretical model to explain differences and patterns in the ways individual students identify with workshop discourse, and to introduce a methodological approach and a set of analytical tools for interpreting students' identification with discursive obligations in a mathematics classroom setting.

While students' accounts of their participation varied in depth and detail, collectively they provided vivid accounts about students' moment-to-moment identification with the discursive practices in which they were engaged. From these accounts it was found that students' explanations could be interpreted in terms of sociocultural identity when viewed through Cobb, Gresalfi, & Hodge's (2009) interpretive scheme for analyzing students' identities at the classroom level. Adapting the scheme as a primary analytical framework for the study, students' explanations were documented as demonstrating particular *modes of identification* in discursive activity—as either

affiliative, compliant, avoidant, or resistant. Of particular interest in the study was the key distinction between affiliation and the other three "non-affiliative" modes. This grouping was meaningful because it distinguished norms taken up as obligations-to-self from those taken up as obligations-toothers or else not taken up at all (Holland, Lanchiotte, Skinner, & Cain, 2001). Discursive activity, in turn, was interpreted as a set of *discursive obligations* that students would need to fulfill to be considered competent participants in workshop discourse. These obligations fell into categories of small-group problem solving, presenting one's own solutions to the whole group, discussing others' solutions with the whole group, interacting with the instructor, and engaging in off-line discussion.

Individual differences

Findings from the study demonstrated that individual differences emerged among students' modes of identification with discursive obligations, where stark differences were evident among individual students' overall patterns of identification with classroom discourse. Of the eight students in the case study, two were characterized as "highly affiliative," as they almost exclusively described affiliation with discursive obligations. These students consistently viewed discourse with other students and the instructor as beneficial for their own learning and academic goals. One student was characterized as "non-affiliative," seldom fulfilling discursive obligations and consistently describing modes of compliance or avoidance with discourse. The remaining five students were mixed in their modes of identification, affiliating in some discursive situations and not affiliating in others. These students' accounts reflected a highly situational aspect of identification with discourse, which occurred as students negotiated aspects of their own identities within the specifics of discursive contexts.

Identity-related factors

Close analysis of students' explanations about their own participation in discourse revealed students' understandings of particular discursive obligations as well as their post hoc interpretations of their modes of identification with those obligations during micro-level instances of workshop discourse. A further goal of the study, however, was also to explore students' descriptions and explanations about why they identified with workshop discourse in the particular ways they did, and what factors might account for any individual differences that emerged with respect to students' modes of identification. Explanations across the eight participants in the case study contained a range of factors that were found to be interpretable against Martin's (2000, 2012) multi-level framework for analyzing mathematics identities. The ways that students invoked identity-related factors from related sociocategorical, external-community, academic and disciplinary, classroomcommunity, and intrapersonal levels indicated that students' navigation of these factors in instances of workshop discourse intersected with their modes of identification. That is, students' explanations indicated that their identification modes were not determined solely by the nature of the discursive obligations themselves, but rather by a complex interaction between the obligations and the ways students negotiated identity-related factors that were particularly salient to them in a given instance of discourse. This relationship formed the foundation for an emergent theoretical model to further analyze and explain students' identification with discourse.

Primacy of positioning

A guiding question that emanates from the initial model then focuses on which IRFs are particularly salient in students' explanations across the workshop as a whole (Guiding Question 2). In analyzing students' invocations of IRFs, a preeminent pattern emerged in which classroom-level

positioning appeared as the most frequently described IRF and also tended to serve as a "gateway" factor in students' explanations. That is, positioning was most often the first-cited factor in students' explanations about their mode of identification, and it also was a primary factor in that students then further explained their positioning in connection to other IRFs acting at various levels in the multilevel framework. Students' descriptions of positioning were interpreted as occurrences of situational roles and orientations participants take up in interaction that contribute to intersubjectivity in discourse (Bucholz & Hall, 2005). Through discourse analysis, students' invocations of these roles were categorized as being related to collaboration, relative competence, vocality, friendship, motivation, and contention. Although minor consistencies emerged among students with respect to affiliation with roles of friendship and avoidance of contentious roles, students' modes of identification with any of the particular "role categories" listed above were largely individualized and situational. Far more salient in students' descriptions of identification, however, was what I refer to as the *role type* associated with a given situational role, operationalized as either equipositional, authoritative, or unilateral. Equipositional roles, in which students described equal status with others, were highly affiliative. Authoritative roles, in which students described positions of unequal status but also described engagement as active, with both partners acting as contributory agents in discourse, were considerably more affiliative than not, though somewhat less so than equipositional roles. Unilateral roles, characterized by one-sided discourse and unequal status, were generally nonaffiliative regardless of whether the student occupied the lower or higher status position.

This pattern was particularly important in the ESP workshop, where students often understood collaborative group work in terms of providing and receiving help. By nature, both of these roles (help provider and help receiver) implied differential status; yet, when they were enacted within an authoritative relationship, they were described as affiliative regardless of the student's relative status

in that relationship. That is, in helper-helpee relationships, students often tended to affiliate with both lower and higher status roles because those roles occurred within an authoritative and not unilateral relationships.

This phenomenon suggests that authoritative forms of differential status can be affiliative and productive for students, provided the discursive context allows for all students to engage as active, contributory agents in discourse. The distinction between authoritative and unilateral enactments of roles, while often subtle, can be consequential. A help receiver, for example, who is exhibiting agency in guiding the discourse to meet his or her goals, who is asking questions, revoicing, contributing alternative ideas, and who perhaps is not *always* in the position of help receiver, may be more likely to affiliate with discourse. A help receiver who finds him or herself in an overshadowing role as less competent, less vocal, or less motivated may be less likely to affiliate, and consequently may be less likely to carry on in the role of help receiver. Interestingly, the case appears to be similar for help providers when higher-status, unilateral roles overshadow the exchange. That is, help providers may be more likely to affiliate with discourse as long as the role is not eclipsed by a more unilateral relationship in which they perceive their own position as unilaterally more vocal, more competent, or more vocal.

Other IRFs

The types of situational roles students described for themselves emerged as having a primary influence in students' explanations of their modes of identification in discourse. As such, I depicted situational roles as a separate factor in students' identification, acting in concert with all other IRFs in the theoretical model (see Figure 6.2). More specific influences of these other IRFs beyond situational roles in the workshop remained as yet unexplored. Subcases of three individual students

revealed that their accounts drew substantially from these levels as they described instances of discourse, but they did so in widely varied ways. But what factors at which levels were most prominent, and how did they intersect with the particular situational roles students took up in discourse? Analyses of the three subcase students showed that at the individual level, students invoked IRFs in their accounts of workshop discourse in individualized ways that were often reflective of the identities they portrayed in their broader narratives about their lives (*vis a vis* Interview 1). The number of levels they invoked varied as well; for example, where Griffin made contact with a broad range of IRFs at various levels, Kaytlin's invocations of IRFs were almost exclusively focused at the intrapersonal level. Each student's descriptions generated a summative "portrayal" of how IRFs, situational roles, and identification modes interacted across their participation in various instances of discourse. These individualized portrayals suggest that identification with discourse is interpretable in terms of the unique IRFs students invoke, and that individual differences among students' identification can in large part be traced to IRFs in this way.

It was also found that these students described their identification with discourse as a complex negotiation *between* particular situational roles and other IRFs at various levels. For example, a student typically would not solely explain an instance of affiliation as occurring because of a situational role as "mutual collaborator," nor solely based on an intrapersonal self-ascription as a "competitive person." Rather, the instance of affiliation might instead be described by the participant as a negotiation between the situational role of mutual collaborator and a self-view as a competitive person, perhaps along with other IRFs that a student brings to bear on the negotiation. This interaction is represented in the final version of the emergent theoretical model, in which the identification with discursive obligations is negotiated in the interactions students describe between

situational roles and other IRFs (see Figure 7.2), formulating an overall theoretical claim in explanation of students' modes of identification with discursive obligations in the workshop.

Interpretations of Students' Invocations of IRFs

Although the ways students invoked particular IRFs and levels were unique to each individual subcase student, patterns among these three students emerged at two particular levels—intrapersonal and sociocategorical—that invite some further discussion. The intention is not to omit other levels or portray them as inconsequential in the explanatory model, for that was not the case. Rather, students' accounts invoked these two levels in ways that perhaps raised further questions to be explored. At some risk of venturing into speculation, I frame this part of the discussion in consideration of possible explanations of patterns (and non-patterns) that emerged with respect to these IRFs, and to set up potential strands of inquiry for further study.

The intrapersonal level

A starting point for this discussion is to acknowledge and explore the prominence of intrapersonal-level identities in students' accounts. For all three students, intrapersonal-level factors were deeply interconnected with the roles and modes of identification. To put its importance into perspective, the intrapersonal level was the only level in the framework that was invoked by all three subcase students. It was also connected to more discursive roles than any other level for all three students, and for one of the subcase students, Kaytlin, it was the *only* level she invoked in her explanations. What this means in a comparative sense is that for these three students, the type of person they understood themselves to be appears as more consequential to their identification with

discourse than who they are as a student, as a math student, or as a member of any community outside of the classroom.

I offer several possible interpretations about the salience of intrapersonal identities in classroom discourse. First, one's description of oneself as a certain type of interactive person can have a level of stability attached to it. When students speak of themselves as particular "types of people" that they believe themselves to be, such descriptions tend to transcend singular contexts and communities. Whitney's self-description of "I tend to like to keep things to myself," for example, is an aspect of her identity that she described about herself in communities outside of the workshop as well as within. Although she described having occasionally contested and reconstructed this self-ascription, she tends to describe these occasions as anomalies against this aspect of herself that she views as relatively stable. It therefore might be conjectured that intrapersonal factors involve more durable forms of identity, which pull as a thread through participation in various communities (including the workshop), whereas factors at other levels may be more locally tied to some particular contexts or communities and not to others. Intrapersonal identities may be different in this way from identities that are constructed at other levels.

Second, discourse itself is a social negotiation, entered into as an individual interacting with other participants. I conjecture that in each discursive instance, this negotiation is occurring through a three-way hierarchy of identity formulations, first as "How do I construct myself in this negotiation?," then as "How am I constructed by others in this negotiation?" and finally as "How do I construct the other in this negotiation?" This first formulation of the "self" one brings into discourse may be the most immediate concern in any discursive instance, and also may be the first lens through which students reflect upon discursive interactions. Intrapersonal identities may therefore tend to serve as an entry point for students' interpretations of the roles they described in

discourse. Thus, Whitney's explanation of her less-vocal role begins with her self-identification as an introverted person; Griffin's explanation of his role as help provider begins with his selfidentification as an altruistic person; and Kaytlin's explanation of her equally competent role begins with her self-identification as a competitive person.

The sociocategorical level

Several researchers have documented how students' identities related to social categories intersect with micro-level interactions in mathematics classrooms (Esmonde, et al., 2009), particularly among students in groups marginalized by race (Shah, 2009) and gender (Langer-Osuna, 2011). Esmonde et al. (2009) in particular found that high school students seldom directly raised issues related to social categories in describing group work, but that students of color and female students were more likely to do so than white students and male students. Furthermore, connections to race and gender could be interpreted implicitly in students' descriptions of discourse, in which students from marginalized categories described more passive roles in discourse.

In the present study, four of the eight total participants identified themselves as belonging to at least one social category generally considered to be marginalized in STEM education (i.e., non-white/non-Asian, female, low socio-economic status). Consistent with the findings of Esmonde, et al. (2009), the four students not belonging to marginalized categories (all Asian American males) did not raise sociocategorical factors as salient to their participation in workshop discourse. Of the four students from marginalized groups, three described some form of marginalizing experiences in their lives related to their social categories. The exception was Marco, who explicitly described his Mexican heritage as "not a huge factor" in his life. His narrative about important communities did not include cues related to a deeply formulated Latinx identity (e.g., language in the home,

connections to a broader Latinx community), nor any recalled instances of marginalization in his academic or social life. He made no references to experiences of marginalization in the workshop.

The remaining three students who were the focus of the subcase analyses each described experiences of marginalization outside of the workshop, and therefore provided an opportunity to explore if and how these experiences intersected with their roles and modes of identification in workshop discourse. While I did not analyze these three students' descriptions as indicating any predictable patterns between sociocategorical factors and identification with discourse within the case-study classroom, it is worthwhile to discuss possible interpretations of the particular ways each raised (or did not raise) social categories in their descriptions. Among these three students, one African American student (Whitney) made prominent, explicit connections between race and workshop discourse, another African American student (Griffin) did not. Neither female student made direct connections to genderized experiences in workshop discourse, even though one of the students in particular (Kaytlin) described deep connections between genderized experiences and her identity related to mathematics and science. The question for discussion is: how are these phenomena—and the striking differences from one student to the next—to be interpreted?

A first consideration is the degree to which students raise sociocategorical factors as salient to their experiences outside of the classroom. To what extent do they identify with aspects of their identity related to social categories? Do they describe racialized or genderized experiences as part of their narrative history? Whitney described her African American identity in ways that suggested a deep and nuanced understanding of herself as a member of the African American community. She was intensely proud of her African American identity, to a level that extended beyond what her parents instilled in her from a very young age, and she described herself as becoming an activist in this regard to the point that even her family was beginning to characterize it as "a little intense". She

also recounted racialized experiences throughout her academic history, as well as personal tension she experienced between being the "smart one" among her social circle of African American friends and often being the only African American student in higher track academic classes. These accounts also included vivid, at-times painful stories of marginalization and stereotyping in these classes that led her to question herself as a competent student.

Whitney's accounts of her racial identity can be contrasted with Griffin's reflections as an African American, in which race was largely described as a non-issue in his social and academic life growing up. Griffin described very few experiences tied to race. His socialization as an African American in his family was primarily about negotiating the inequities of opportunity he was likely to face in his future professional life. His ties to African American culture were largely contained within his family group, and he had few African American friends growing up. He did not recall any instances where he experienced the effects of overt racism, stereotyping, or marginalization.

Perhaps in light of these contrasting accounts it is not surprising that race was salient in Whitney's descriptions of workshop discourse, but not in Griffin's. Where Whitney spoke explicitly about her affiliation to engaging in discourse with other African American students, and with the instructor because of their shared race (in the context of racialization in the United States), Griffin made no such references himself and dismissed them when prompted directly. One interpretation is that Whitney's particular lived experiences as an African American have attenuated her capacity for interpreting and navigating racialized experiences. Informed by her own nexus of experiences within her family, within her classrooms in a tracked/segregated school community, and as a culturally engaged African American student at the university, she developed lenses, tools, and strategies that she was able to apply in discursive situations in the workshop. In this way, Whitney's invocation of factors related to race may imply aspects of *resilience* demonstrated by successful students in STEM

documented by McGee (2009, 2015). Griffin, on the other hand, who recounted far fewer—and less consequential—experiences related to race may not have developed interpretive lenses to the extent that Whitney had. I speculate that, while this may have reduced his sensitivity to, and possibly insulated him from, racialized experiences in his daily interactions to some degree, it may also have limited his capacity to identify, interpret, and respond to racialized experiences when they arose.

Whitney and Griffin often worked together in the workshop, and consistently described affiliation in their shared instances of discourse. Whitney readily attributed this to their shared race—in fact described arranging to work with Griffin *because* of this commonality. Griffin, on the other hand, essentially "fell into" this partnership and did not interpret race as a salient factor in his affiliation with it. I speculate that Whitney's agency toward seeking out this supportive collaboration was tied to her strong African American identity, and demonstrated a capacity for navigating race in her academic life that she would be able to use in other collaborative academic environments as well.

The comparison of Whitney's and Griffin's subcases suggests that sociocategorical factors became salient in workshop discourse for students who: a) were in marginalized groups, and b) described sociocategorical factors prominently in their lives. This conjecture was contradicted, however, in comparing the ways the two female participants, Whitney and Kaytlin, invoked gender in their descriptions of workshop discourse. In Whitney's case, she did not describe significant genderized experiences in any of her interviews. There are many possible explanations for why this might have been the case, but I apply an assumption that in light of her candid and introspective descriptions of other aspects of her identity, concerns about gender-related equity and marginalization were comparatively less salient in her life, and consequently less salient in her

workshop participation as well. In this way, Whitney's account aligns with the conjecture offered above.

In Kaytlin's case, however, gender issues played out in a very different way. For Kaytlin, gender was a focal point of her accounts of previous academic experiences and of her mathematical and scientific orientations. For example, she recounted struggles with maintaining her interest in mathematics and science through middle school and high school against prevailing narratives about "what should matter for girls instead"-namely, looks, popularity, and being fashionably nonacademic. Despite these struggles-perhaps in light of these struggles-Kaytlin was able to sustain a strong gender identity and re-establish a strong academic identity through her storyline, leading to her current studies in a STEM-related major. Yet, despite the ascendancy of gender in her broader narrative, it was not invoked as a factor in her accounts of workshop discourse even when prompted directly in this regard. This is noteworthy in that Kaytlin most often worked in a workshop group with two other male students, with whom she often described a competitive relationship and a role of comparatively lower mathematical competence. I speculate that this "de-genderization" of her interpretations may have been a way for Kaytlin to decouple the success she was experiencing in this small group from an explicitly genderized interpretation. That is, although Kaytlin may have implicitly viewed discourse in this small group through a genderized lens, it may also have been important that she account for her competence on strictly academic/mathematical terms—perhaps particularly so in an interview with a male researcher. This interpretation fits with the competitive intrapersonal identity that was prominent in her descriptions, where Kaytlin's individualistic desire to ascend to the role of "more competent" might supersede gender identification within this context.

Thus, in addition to a student being part of a marginalized group and describing sociocategorical factors prominently in broader experiences in their lives, a third consideration for how students

invoked sociocategorical factors in workshop discourse was whether such factors might have been overshadowed by other, more immediate factors. Overall, these three subcases only began to portray the complexities of how students—particularly these students from marginalized groups interpreted and navigated macro-level, categorical factors within workshop discourse.

Implications for Practice

Examining ESP design assumptions

The establishment of collaborative, discursive environments for students to engage in rigorous problem solving has been a central design feature of the Emerging Scholars Program workshops since their inception four decades ago. As I discussed in the review of the literature on ESP, this aspect of the design was enacted in part to address needs of under-represented students as they were understood from ethnographic studies comparing students' study routines from different ethnic groups. Although ESP was not designed exclusively for African American and Latinx students, there was particular attention in the design to addressing these students' pathways to success in introductory university calculus courses. As documented in the literature, collaborative structures were introduced into the workshop design specifically to create a public sense of "shared struggle" among students, which was intended to allay the sense among students from underrepresented groups that Asian and white students do not struggle with demanding mathematics. Relatedly, there was an assumption this shared experience of struggle could reduce stereotype threat among African American and Latinx students. That is, if minority students saw Asian or white students needing to persist to succeed in their learning of calculus, it might serve to erode minority students' linking their own struggles to racial stereotypes. While my intention in this discussion is not to undermine the worthy intentions of the ESP design or to call into question the historic, well-documented

success of the program for students who have benefited from it over the years, the present study does represent an opportunity to apply the empirical lens of sociocultural research to the design assumptions of the program, particularly with respect to students from marginalized groups, including African American, Latinx, and female students.

I interpret the findings from this study as supporting these design assumptions at one level, while giving cause to problematize them further at another. Overall, students in the workshop—including those from marginalized groups—described affiliation with discursive instances substantially more often than not. For the majority of participants, this affiliation was described in direct contrast to their experience in the calculus lecture and TA section where opportunities for discourse and collaboration were rare. Interpreted at this level, the workshop design broadly delivers on the assumption that students would broadly encounter collaborative, discursive instances in affiliative ways, which would in turn support productive engagement with solving demanding calculus problems.

A closer look at identification, however, revealed that certain roles taken up in discourse were described by students in more affiliative ways than others. Unilateral roles were prevalent in workshop discourse, for example, and were generally accompanied by non-affiliation. Despite an implementation that appeared to be closely aligned to the design principles of the workshop, unilateral roles and their associated issues of differential status remained unmitigated among particular groupings of students. Furthermore, although there were some indications that stereotype threat was mitigated for the three subcase participants through experiences of a "shared struggle" across races and genders, for one subcase student strong feelings of stereotype threat, differential status, and discomfort persisted nevertheless. Ultimately this African American student adopted a strategy of working primarily with other African American students in the workshop.

Similar to implications suggested by Esmonde, et al. (2009) from their secondary-level study, these findings provide further evidence of the complexities involved in mathematics discourse and group work among diverse groups of students. While a design predicated on a discourse-rich environment may provide affordances for student learning otherwise largely not available to marginalized students, such designs cannot be interpreted as categorically "meeting the needs" of an entire group of African American students, Latinx students, or female students. Such an approach risks overlooking the individual, diverse identities that students from each of these groups coconstruct within the workshop community. Part of those diverse identities are comprised of how these students interpret their identities related to these broad social categories to which they are assigned. As can be seen from the three subcase students in this study, students construct this part of their identity in vastly different ways, and therefore they will identify with a diverse, discursive mathematics community in highly situational ways as well. Asera (2001) goes part of the way in this regard by highlighting the fact that different subgroups encounter different realities, and therefore all "minority" students cannot be considered homogeneously with respect to design and implementation of the workshop, but this approach still risks an essentializing of, say, African American students as all sharing common challenges and needs with respect to learning mathematics. As has been illustrated in this study as well as Oppland & Martin's (2014) study of Latinx students' experiences in ESP, students' identities are individualized and should not be over-essentialized across entire marginalized groups. Designing instruction for an entire group this way can contribute to consequential oversimplifications of complex phenomena.

Implications for ESP design

One of the more clearly distinguishable findings of this study involved the connection between unilateral roles and non-affiliation with discourse. That is, when students described themselves in one-sided roles in discourse (e.g., more/less vocal, more/less motivated, more/less competent), they tended not to affiliate regardless of whether they occupied the higher- or lower-status role in the instance. These unilateral roles were distinct from students operating in help receiver/help provider roles, which also involved differential status, but with which they far more often described affiliation. As a design consideration, then, a goal might be to facilitate equipositional discourse and helper/helpee discourse, and to minimize unilateral discourse.

A consideration in workshop implementation, then, might be to introduce specific structures to support the emergence of more equally vocal roles or help receiver/provider roles in particular. Recommending a full set of such structures is beyond the scope of this study, but I offer one illustration, which draws from some of the principles of Complex Instruction (Cohen & Lotan, 1997, 2014) and is specifically tailored to this case study workshop. Based on observations of how some groups tended toward unilateral discourse, it was often observed that the student who was farthest along in a solution to a given problem would initiate discourse with an explanation of his or her solution, at which point students who were still in earlier stages of their own solution strategies would disengage from discourse (and subsequently describe themselves in less-competent or less-vocal roles during the phase-2 interview). Perhaps a structure that could mitigate this circumstance would be to have students in the earlier stage of solution initiate discourse, explaining what they have done so far and what they are thinking of doing next, or else why they are stuck. This type of structure has the potential of converting unilateral discourse into help-oriented or equipositional exchanges in some cases.

Agency in workshop discourse

A more expansive consideration, however, stems from the compelling ways that students exhibited agency in creating discursive contexts in the case-study classroom, both for themselves and their peers. This occurred in several ways. The most explicit form of agency was demonstrated through students' self-arrangement into groups in which they could more readily take on affiliative roles. Most students described targeted efforts to work with students whom they believed were good matches to their style of working and talking, and to avoid working with students that they believed were not good matches. This "self-matching" was laden with implicit issues of status and positioning as detailed in previous chapters, though it generally resulted in most students coagulating in consistent groupings which seemed to minimize their non-affiliative discursive roles and relationships over time. (It should be noted here again that one student, Justin, seldom actively worked with any other students, most often tuning in and out of conversations of the group he was sitting nearest to. From his interview data, this was intentional on his part, and related to his overall approach to the workshop of "taking things in and learning from what others are doing".)

Another more nuanced form of agency, however, was demonstrated in the ways students negotiated roles in discourse in service of their own goals for themselves in the workshop. Marco described such agency in his "business approach" to the workshop in which he would scan students across the classroom to figure out who would be able to help him, and then approach that student for advice on solving the problem. Whitney described intentionally coming off as "less competent" relative to peers so that they would be more likely to engage in productive conversation that she would ultimately find more helpful. Griffin, Jay, and Marco all described helping other students because of the altruistic feelings it brought up for them, making them more inclined to stay engaged where they might have otherwise lost focus. Sam described soaking up every opportunity to talk

through problems to make up for lost time during all the years that he struggled to learn mathematics in isolation while being home-schooled. Each of these instances illustrates some of the complex forms of agency that students demonstrated within the context of the ESP community, but often independent of any specific workshop design features intended to support these forms of agency.

The impact of students' forms of agency on their construction of affiliative opportunities for discourse suggests that a key, though perhaps overlooked, aspect of the ESP design is the space it allows for students to exercise agency toward their own productive discourse. While I ascribe to the notion that specifically designed structures could potentially have supported more equitable, affiliative discourse in the workshop across intentionally diverse groupings, at the same time, such structures need to be balanced with maintaining a space where students can exercise agency on their own behalf, and on the behalf of the learning community. As imperative as it is to somehow address issues of status and stereotyping that create inequitable opportunities to learn in the workshop, it is equally imperative to maintain pathways for students to negotiate their own affiliative discourse within the classroom ecology as it emerges. In this sense, overdesigning student groupings might serve to enhance group diversity, but also might have disallowed Whitney's interaction with other African American students, in which her most affiliative opportunities for discourse occurred.

Video modeling and self-reflection

One final implication for practice is a consideration of the benefit of students' reflection on their own participation in the workshop. The method of video modeling was adopted by Kotsopoulos (2010) in mathematics education research as a process for students to observe their own discursive processes in a collaborative mathematics classroom environment, and to enhance their communication strategies through stimulated reflection. While its intention in this study was not

necessarily to support specific communication strategies, students did notice aspects of their participation in discourse in this regard. Comments such as "I should speak up more"; "I seem really distracted a lot"; "I need to give other people a chance to say things"; or "I wasn't really listening very well there" were all commonplace in phase-2 interviews. Although this level of discursive behavior was not part of my analysis, it is conceivable that students may have been influenced by these self-observations in subsequent turns of discourse in the workshop.

At a broader level, several students in the case study described (without an explicit prompt) how the overall interview process had some influence on how they thought about their participation in the workshop. Toward the end of her second interview, for example, Whitney shared this reflection about the process, which was somewhat typical of others' reflections as well.

Whitney: It was helpful for me to think through some of the questions on- like when you asked why do you think you do this? because I don't always think about why I do things. I just do it unconsciously. I try to just think more about myself these days? I don't know if I always think about it? so I feel like when you say like what was the thought behind it ((nods)) it's interesting to me.

Here Whitney described value and personal interest in the process of self-reflection as a way to make the "unconscious" conscious. An implication is that much of her interview reflections were a construction of recalled occurrences, emotions, and interpretations from specific workshop sessions, *re*constructed through her own interpretations and narrations within the interview process itself, akin to Sfard and Prusak's (2005) formulation of identity-as-narrative. In this sense, the interview reflections represented documentations of participants making sense out of their lived experiences of discourse in the workshop. This sense-making process was described by a subset of participants to be of expressed value to them. I did not pursue their understanding of this value any further than what students initially offered (as in Whitney's excerpt above), but it is conceivable that the reflection process itself might enhance students' sense of agency over their own participation in more affiliative modes of discourse. While this consideration is largely speculative, self-reflection may be worth further exploration as a tool for enhancing students' forms of participation in productive group work in mathematics.

Limitations of the Study and Methodological Implications

In this study I asked students to review and interpret their own participation within the classroom community, probe their worlds beyond the classroom community, and to look within themselves. This was an ambitious project for both participants and researcher in the wide net that it cast, attempting to mobilize students' capacities for making meaning about potentially salient aspect of themselves and their experiences, all in connection to the very specific act of talking about calculus problems in a college math workshop. There were some unique challenges in this approach. In this section I describe some specific challenges and limitations in the study, and indicate how I addressed these limitations where possible. These limitations were primarily related to the need for privileging students' perspectives, and timing and logistical issues that may have influenced data collection.

A first limitation was the reliance on open-ended interview data from students' perspectives as the primary data source. Given the research questions of the study, this approach was necessary to document students' identification with discursive obligations in the workshop. As a construct, identification with classroom practices is at some level an individual, interpretive process as much as it a participative process. A central aspect of identification involves a participant's interpretation of to whom he or she is obligated in carrying out discursive obligations. The issue of "to whom" is generally not visible in students' fulfillment of obligations, even through careful observations of discourse. It emerges out of interview-based reflection directed toward the "whys and wherefores" of participation in discourse.
Privileging student interviews to this degree, however, introduced some interpretive caveats. First, there was a constant tension between facilitating reflections that addressed the project's research questions and overprevileging the concerns of the researcher over the those of the participant. For example, because of time and logistical constraints, the researcher selected video clips for phase-2 interviews from representative samples of each student's participation in discourse. As such, the set of clips used emphasized a limited, specific set of instances that introduced the researcher's bias toward what were "representative" episodes of discourse. These instances might not have matched participants' ideas about what the most important, representative aspects of their participation were. As students used these clips to launch into their own reflections, the salient issues they raised might have differed based on which clips were selected, and by whom. In a similar vein, an open-ended interview approach introduces the possibility of the interviewer implicitly directing students' reflections toward researcher concern over their own concerns through the interview process itself, through which threads are explored further, and when threads are get let go. Although efforts were made to limit the amount of "leading"⁴, findings from analysis of interviews must be interpreted as a co-construction of meaning by both participant and researcher.

Second, the time lag between videotaping of observations and the phase-2 interviews may also have influenced students' phase-2 reflections. Due to scheduling constraints, phase-2 interviews were conducted between 1 and 4 weeks after videotaped class sessions. Because of the time lag, students' reflections often lacked clear recall of details beyond those directly viewable on the video excerpts. As such, some detailed aspects of discourse that were not readily available in the video

⁴ As an example of an effort to reduce "leading" of participants toward what they might think the researcher was expecting to hear, I followed a relatively strict guideline of delaying questions about a specific identity-related factor in the phase-2 interview until it was clear that a student was not going to raise it on his or her own. At that point, I would ask about the factor in a way that encouraged the student to either reject it as not relevant to the instance or else explore it further.

(e.g., the mathematical nuances of problems being discussed, or the particular mood of a student during a given session) may have been underemphasized in student reflections. Conversely, broader recollections about student relationships or more durable feelings about participation in general would have been privileged in these reflections. Findings should be interpreted with these limitations in mind as well.

Third, student accounts in interviews occasionally did not triangulate with observation data. While gross misalignments were not common, when they did occur they were likely due to one or a combination of several factors. Participants may have shared interpretations of classroom instances that reinforced constructions of themselves or others in the workshop, even to the extent of misrepresenting occurrences. To some degree, such misrepresentations were not considered a threat, but rather were integrated into the analytical approach, where identification was framed largely as an interpretive act focusing on students' construction of themselves both in practice and in reflection.

Interpretations of findings should also take into account the elective nature of the workshop course. Because students opted in, a level of affiliation among students might be expected beyond that of a required college-level course, or else perhaps a compulsory secondary-level mathematics course. Workshop students exercised agency in registering for the course, implying an obligation-to-self in their overall participation in the workshop. Interpreting the results in any generalized ways beyond this workshop classroom must account for consequential differences in participants' agency in enrollment, as well as other contextual and participant-related factors such as students' age, grade-level, mathematics content, past achievement, diversity or homogeneity, and the nature of the school and classroom community.

Perhaps the primary methodological challenge in this work was to pull an empirical thread from micro-level classroom interactions, outward to the most expansive societal factors of students'

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identity development, and also back inward toward students' highly personalized constructions of themselves. This multi-level analysis involves the challenging process of coupling what can be observed in the classroom to students' experiences outside of the classroom. As discussed earlier, important work has been done in this vein particularly in connecting social-historical-level issues of race and gender to students' identity construction in mathematics classrooms (Esmonde, et al., 2009; Shah, 2013). A consistent challenge cited in these and other studies is capturing the influence of sociocategorical factors in the classroom first-hand and in real time. I introduced video-modeled stimulated recall as a useful method for bridging directly observable classroom instances with participants' broad, "10,000-foot-level" narratives about their identity development. While subject to specific limitations described above, the method provided a unique view not only into how students were influenced by certain factors during discourse, but also the ways students made sense of their experiences through the process of the interview itself.

Further Research

The subcases of Whitney and Griffin portrayed two highly divergent ways that African American students connected racial factors to micro-level instances of workshop discourse. Earlier I explored some possible interpretations about how these two students made these connections, highlighting them as individualized, situational cases from among the countless possible narrative pathways by which students might connect race and classroom discourse. In some ways, their cases represent two ends of a spectrum: Whitney as readily navigating and interpreting discursive instances in the workshop through a lens of race and racialized experiences, Griffin as largely separating issues of race from workshop discourse. Drawing from the experiences of only two African American students, their cases can only be interpreted as far as to show that race is salient

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for at least some African American students in the ways they participate in discourse, and that it is not salient in the same way—or even in comparable ways—for all African American students. That is not to downplay the importance of this interpretation as demonstrating the imperative of not essentializing the experiences of African American students in relation to classroom discourse. To further understand the full range of how students make (or do not make) these connections, an area for future study would be to focus similar research on a larger subgroup of African American students. Such research could provide a fuller picture of how race and racialized experiences are invoked as salient in micro-level instances of discourse. It could also begin to address the question of how students' meaning-making of race in relation to classroom discourse might either support or challenge their positive identification with discursive practices. Here I highlight Whitney and Griffin as contrasting cases involving racial categories; a similar contrast emerged between Kaytlin and Whitney with respect to gender and genderized experiences. Future research on a larger subgroup of female students could similarly provide a broader range of narratives that invoke gender identity as salient to participation in classroom discourse.

As discussed previously, contextual factors played an influential role in the phenomenon of identification. Without comparison to other contexts, it is impossible to interpret whether findings in this study would reflect those in classrooms at different grade-levels, in different institutional settings, with different levels of sociocategorical heterogeneity/diversity, and with different instructional designs. Another direction of future research could involve expanding similar research to a broader range of contexts. This would imply a need for methodological adjustments, particularly for younger students who might be less ready to reflect on connections to factors at the sociocategorical and intrapersonal levels. Yet, understanding students' micro-level processes of identification in their more formative years of mathematics socialization may be arguably more

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important than in early undergraduate years when mathematics identities have already "thickened" substantially through histories of success and failure.

Related to thickening of identities, a third future direction of research might focus on how the individual, micro-level instances studied in this project accumulate over time toward students' enactment of more stabilized forms of identification during the course of a semester, academic year, or beyond. In the present study, the time-scale at which identification was studied was fixed on micro-level, momentary interactions analyzed largely independently from one another as a way to analyze patterns as they occur within episodes of discourse. Further related research might focus on how such instances add up over time, shifting the unit of analysis from the classroom to individual students being observed and interviewed at very close intervals. A simple way to frame this research might be to ask, did students' modes of identification with discourse remain constant over the case study, or did they change over time? If the latter, did modes of identification coalesce around predictable patterns, and if so, what situational and identity-related factors influenced these patterns? This approach could provide coherent narratives of how students navigated, negotiated, and interpreted a series of instances of discourse. Given that even the most carefully designed classroom ecologies are still subject to issues of differential status and inequitable opportunities to engage and learn through discourse, understanding how students successfully navigate these issues toward more affiliative experiences could represent a valuable further contribution to research on collaborative discourse in mathematics classrooms

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APPENDIX A: SAMPLE WORKSHEETS FROM CALCULUS I WORKSHOP



Fall 2011

- 1. Find the following indefinite integrals (a.k.a. antiderivatives).
 - (a) $\int 2 dx$ (b) $\int (9-x)^2 dx$ (c) $\int \sin(9x+5) dx$ (d) $\int (4\theta + \cos 8\theta) d\theta$ (e) $\int te^{t^2} dt$
- 2. Suppose F is an antiderivative of f, and G is an antiderivative of g, that is, F'(x) = f(x) and G'(x) = g(x). For each of the following, show that it must be true or give a counterexample.
 - (a) If f = g then F = G.
 - (b) If F and G differ by a constant, then f = g.
 - (c) If f and g differ by a constant, then F = G.
- 3. Suppose that F is an antiderivative of f, that is, F'(x) = f(x).
 - (a) Show that $\frac{1}{2}F(2x)$ is the antiderivative of f(2x).
 - (b) Find the general antiderivative of f(kx) for any constant k.
- 4. A car traveling at 84 ft/sec begins to decelerate at a constant rate of 14 ft/sec². After how many seconds does the car come to a stop and how far will the car have traveled before stopping?

filename: ~/teaching/179math_F11/worksheets/23_antiderivatives.tex

Interview Protocol T. Stoelinga Dissertation Research Project

INTERVIEW 1 – Identity and Multimembership (Timeline: Weeks 4-6)

NARRATIVE TARGETS

To establish potential connection points between participants' identification with workshop discourse and their identities related to memberships in social communities. Interview 1 targets participants' identities related to:

- Meaningful membership in:
 - o Family
 - School/academics
 - Peer groups
 - Current job or future professional aspirations
 - Academic aspirations (e.g., post secondary)
 - Co-curricular activities, clubs, teams
 - Church/religious communities
 - Neighborhood community
- Mathematics and mathematics education
- Experiences of marginalization in academics or mathematics education specifically

FORMAT

Individual interview, conducted following several informal observations of the participant interacting in the classroom environment.

~60 minutes

PROTOCOL

PART 1: ESP Participation Background (15 min)

I just want to start with some basic questions about your math courses here at UIC.

- 1. So of course you are in Calc I as well as the ESP workshop. Is Calc I a requirement for your major? What is your major? Ok, we'll get back to more questions about your major a little later.
- 2. What made you decide to enroll in the ESP workshop?
 - i. How did you find out about it? Or from whom?
 - ii. What kinds of students do you think sign up for the ESP workshop? (Status)
- iii. How is the program different from other experiences you've had learning math?
- iv. How is it the same?
- v. What benefit were you hoping to get out of it when you started?
- vi. Do you feel like it's been worthwhile so far? (Remember this is CONFIDENTIAL)

PART 2: Mathematics Identity (10 min)

- 1. Do you think you are "good at math"? Why? Have you always been or has that changed?
- 2. Is it important for you to learn math? Why or why not?
- 3. Describe a time when math came up in a conversation at home. With friends?
- 4. Describe something you remember from a high school math class.
- 5. What are some of the most difficult things about learning calculus this year? What are some of the most enjoyable things about it?

PART 3: Meaningful memberships (10 min)

Say: In our lives, we're all part of different groups and communities. In my life, I'm a student and researcher at UIC, and I'm also a dad, I play music in a band, I belong to a cycling club, I hang out with friends, that sort of thing. I'd like to know a little bit about what kinds of groups are important in *your* life.

[Provide "Community Participation Rating Sheet.] So short worksheet with some groups shown on it that you might be a part of, and also some blank lines at the bottom. Please take a couple minutes to look through each group listed, and then write the number of stars in the box that best describes how important the group is to you. For the blank lines, you can fill in with whatever you'd like, but you don't have to fill in the blank lines. Remember, this conversation is completely confidential, and I won't be sharing your card choices or any of what you say with your teacher, parents, or classmates.

LABELE AS:

- Very important to me
- Somewhat important to me
- Not very important to me
- Can't decide
- I'm not a member of this group

GROUPS INCLUDED:

- My family (parents, grandparents, brothers, and sisters)
- My extended family (aunts, uncles, cousins, etc.)
- My school
- My algebra class
- A class other than algebra:
- My closest group of friends
- My church group
- A sports team
- A school club
- People in my neighborhood
- My African American culture
- People I work with at my job
- Becoming a _____ in the

- future
- My community center
- People who share my interest in
- Some other group? _____
- Some other group?
- Some other group? _____

[Collect worksheet, anonymized using assigned student ID number.]

For the "very important" choices, use the following prompts to help start a conversation about the student's participation in that community:

- 1. Tell me about [choice]. Why did you put this in the "very important" circle?
- 2. Can you tell me about a time when you felt like you were a really important part of that group?
- 3. If I could see you being "part that group," what would I see you doing?
- 4. How would other members of this group describe you?
- 5. Do you think you'd like to have an even more important role in that group? [If not] Why not?
 - [If so] What would that role look like?

INTERVIEW 2 – Stimulated Recall (Timeline: Weeks 9-10)

NARRATIVE TARGETS

To draw connections between participants' participation in instances of workshop discourse and their identities related to memberships in social communities, particularly those identified in Interview 1.

FORMAT

Interview with individual student, conducted within one week following last videotaped observation included in the excerpts to be shown. Participants will be shown specific segments of video of their participation in 6-8 instances across several workshops, selected based on "representative and interesting" samples of students' participation in discourse across several activity types.

~60 minutes

PROTOCOL

For each selected segment, use the following prompts to begin a conversation about the student's participation in that segment:

1. Show the problem worksheet that indicates the problem being worked on during the video segment to establish mathematical context. Give student a bit of time to re-orient to the mathematics.

Ask:

- 2. Tell me about this segment. What do you notice?
- 3. How would you describe your participation here?
- 4. Why do you think that is so?

- 5. What else do you notice going on here?
- 6. [If applicable] It looks like you started to take the activity in this direction [in contrast to the written or explained activity]. How did you decide to take it there?

If these themes have not already emerged on their own, ask specific questions directed at connections to multimembership and communities identified in Interview 1. Ask:

- 7. Back in the first interview, you indicated that ______ was "very important". [Name the community selected.] So these groups are very important in your life and to who you are. Is there any connection between ______ and your participation in this activity?
- 8. In the first interview you also talked about ______. Do you think that makes a difference—one way or another—in the way you participated in this activity?

As the video viewing and conversation continues in this way, look for connections participants make to aspects of community membership, mathematics identity, social categories, or experiences of marginalization that were raised during Interview 1. Ask follow-up questions if and as these connections arise.

As the video viewing and conversation continues in this way, look for connections students make to aspects of community membership, mathematics identity, African American identity, and racial identity that were raised during Interview 1. Ask follow-up questions if and as these connections arise. See illustration questions from Interview 2 protocol.

Closing question:

1. We've done a lot of thinking and talking together about who you are, about these activities, and about your reflections on them. I really appreciate your generosity and bravery in joining in all of this videotaping and discussion. I realize that some parts of it may have been challenging and difficult, and so thank you for sticking with it, and mostly for teaching me about yourself and your experiences. I have learned a lot from you! Is there anything else you'd like to share that maybe we haven't talked about yet that is really on your mind?

Okay, thank you again, and good luck to you!

APPENDIX C: COMMUNITY PARTICIPATION RATING SHEET

How meaningful are each of the following communities to you?

*** Very important to me ** Somewhat important to me * Not very important to me

If not involved with this community or group, leave blank

My family (parents, grandparents, brothers, and sisters)
My extended family (aunts, uncles, cousins, etc.)
My cultural heritage/community
The university community
Other students, professors in my major
My field of study (e.g., biologists, engineers, etc.)
My calculus class and/or ESP workshop
Course(s) other than mathematics
My college friends
Social fraternity
My friends outside of college
Boyfriend/girlfriend
Church group
Academic club
Other academic support organization
Sports team, club, or group
People in my neighborhood
Local community group
Online community (gaming, online social network, etc.)
People who share my interest in
Other:
Other:

Timothy M. Stoelinga

Senior Program Associate Learning Sciences Research Institute University of Illinois at Chicago 1240 W Harrison St., Suite 1535 (M/C 250) Chicago, IL 60607-7019 Office: 312-413-1888 <u>stoe@uic.edu</u>

RESEARCH INTERESTS

- Studying interventions that support equitable learning in key transitional content areas, particularly rational number, algebra, and introductory calculus
- Investigating the interaction among instructional design, the teaching and learning of mathematics content, and students' identity development as it occurs in classroom communities
- Understanding the impact of status and positioning in mathematics classroom discourse for marginalized groups of students in STEM education

EDUCATION

Doctoral (ABD)	Curriculum Studies
2009-present	University of Illinois at Chicago (UIC), Chicago, IL
	College of Education, Department of Curriculum and Instruction
	Dissertation Project: Students' Identification with Discursive Activities in an Introductory
	Calculus Workshop
	Dissertation Committee: Dr. Danny B. Martin (Chair), Dr. Gregory V. Larnell, Dr.
	Joshua Radinsky, Dr. Melissa S. Gresalfi, and Dr. Edd V. Taylor
M.Ed.	Curriculum and Instruction
1996-2000	Loyola University of Chicago, Chicago, IL
	College of Education
B.S.	General Engineering
1986-1991	University of Illinois at Urbana/Champaign, Urbana, IL
	College of Engineering

ACADEMIC APPOINTMENTS

2008-present	Senior Program Associate University of Illinois at Chicago (UIC), Chicago, IL Department of Liberal Arts and Sciences Learning Sciences Research Institute Serving as key research personnel on three Federally funded mathematics education research projects: Center for Cognition and Mathematics Learning ("Math Center," funded by IES); Improving Formative Assessment or Supporting Teaching of Algebra (iFAST Algebra, funded by NSF); and Assessing the Impact of <i>Intensified Algebra</i> —A Technology Enhanced Model of Double-Dose Algebra I for Underprepared Ninth Graders (funded by NSF). Previously conducted strategic planning, research, professional development, and authoring for two NSF-funded K-12 mathematics curriculum projects: <i>Intensified Algebra</i> and <i>Math Trailblazers</i> . Previously served as Co-director for the Teaching Integrated Mathematics and Science (TIMS) Project during development of the 4 th Edition of <i>Math Trailblazers</i> .
Fall 2013	Adjunct Faculty Northwestern University, Evanston IL College of Education Master of Arts in Teaching, Secondary Mathematics and Science Program
Fall 2012	Adjunct Faculty University of Illinois at Chicago (UIC), Chicago, IL College of Education Mathematics for Elementary Education Majors
2007-2008	Teacher Education Consultant University of Chicago, Chicago, IL Urban Teacher Education Program Collaborated with university stakeholders on the design of a new B.A./M.A.T. licensure program for secondary teachers in mathematics and science; conducted research on current literature and national trends in secondary mathematics/science teacher preparation; wrote and presented program proposal to the Illinois State Board of Education (ISBE); designed program framework, coursework, internship experiences, assessments, and plans for implementation; correlated design to ISBE professional teaching standards.

PK-12 EDUCATION APPOINTMENTS

2005-2007 **Director of Mathematics**

Boulder Valley School District, Boulder, CO

Coordinated the design and implementation of standards-based curriculum for all K-12 mathematics programs district-wide; directed team of mathematics specialists and coordinators; directed professional development for teachers district-wide; managed budget for district mathematics department; interfaced with principals to

support instructional leadership in mathematics; built and maintained partnerships with universities, community organizations, and other school districts to advance instructional practices; collaborated with team of district directors to support lowachieving students; initiated early-intervention program for primary students in mathematics; authored two funded grants for improving student mathematics achievement in BVSD; coordinated district instructional technology for mathematics.

2003-2005 Mathematics Program Facilitator and Instructional Coach

Chicago Public Schools, Chicago, IL

Coordinated citywide curriculum for under-performing ninth graders in mathematics; lead and provided professional development for secondary mathematics department chairpersons and teachers district-wide; provided instructional coaching and implementation support for secondary mathematics programs; collaborated with partners from local universities to prepare elementarylevel teachers for grade-8 algebra instruction.

1997-2003 Science Department Chair

Archbishop Quigley Preparatory Seminary High School Developed new curricula for courses in Advanced Placement Physics, conceptual physics, and Integrated science; supported new science teachers through mentoring and team teaching; coordinated departmental budget and curriculum material selection; advised on school-wide curriculum planning.

1994-2003 Mathematics and Science Instructor

Archbishop Quigley Preparatory Seminary High School Taught physics, physical science, integrated science, precalculus, advanced algebra, geometry, and algebra; implemented inquiry-based programs of instruction in mathematics and science emphasizing student discourse and conceptual understanding; integrated instructional technology, including automated data acquisition and simulation software, into daily instruction; coached Illinois Science Olympiad team, Worldwide Youth in Science and Engineering team; varsity boys volleyball team; and junior varsity boys basketball team.

INDUSTRY APPOINTMENTS

1992-1994 Civil Engineer

Professional Service Industries (PSI), Inc. Designed foundations and performed soil analysis for various commercial building projects; performed on-site engineering inspection for large-scale construction projects.

FUNDED RESEARCH

Title: Bridging the Gap: Boulder Partnership for Excellence in Mathematics Education

Sponsor: Colorado Department of Education Math/Science Partnership Program Amount: \$593,791 Period of Performance: 09/01/2005 – 08/31/2008 Lead PI: T. M. Stoelinga Co-PI: D. C. Webb

PUBLICATIONS

Peer Reviewed Articles

- Tidd, S., **Stoelinga, T.**, Bush-Richards, A., De Sena, D., & Dwyer, T. (in press). An intensification approach to double-block algebra: A pilot implementation of *Intensified Algebra* in a large urban school district. *The Journal of Educational Research*.
- Martinez, M., Bragelman, J., & **Stoelinga, T**. (2016). Underprepared students' performance on Algebra in a double-period high school mathematics program. *The Mathematics Educator, 25*(1), 1-31.

Invited Policy Briefs

Stoelinga, T. & Lynn, J. (2013). *Policy brief: Algebra and the underprepared learner*. Chicago, IL: Research on Urban Education Policy Initiative, University of Illinois at Chicago.

Articles Under Review

Soffer-Goldstein, D., Pellegrino, J. W., Goldman, S. R., **Stoelinga, T**., Heffernan, N. T., & Heffernan, C. L. (under review). The effect of Automatic Reassessment and Relearning on the retention of mathematical knowledge and skills.

Articles in Progress

Stoelinga, T. M., Soffer Goldstein, D., Heffernan, C. L., Pellegrino, J. W., Goldman, S. R., Heffernan, N. T., & Ostrow, K. S. (in progress). Comparison of types of feedback provided during technology-based practice of mathematics skills.

HIGHER EDUCATION TEACHING EXPERIENCE

Northwestern University, Master of Arts in Teaching Program

MS ED 479: Practicum Seminar for Secondary Mathematics and Science (Co-developed Course, Fall 2014)

University of Illinois at Chicago, College of Education

ED 194: Special Topics in Education: Mathematics for Elementary Teaching (Co-developed Course, Fall 2012)

SELECT PRESENTATIONS

Peer Reviewed Conference Papers, Posters, and Presentations

- **Stoelinga, T.,** Lynn, J., Castro-Superfine, A. (accepted). *Challenges of an RCT in the context of an algebra curriculum implementation*. Conference paper submitted for the 2017 NCTM Research Conference, San Antonio, TX.
- Stoelinga, T. M., Soffer Goldstein, D., Heffernan, C. L., Pellegrino, J. W., Goldman, S. R., Heffernan, N. T., & Ostrow, K. S. (2016, April). Evaluating differences in students' learning and retention of mathematics skills given various forms of feedback. Poster session presented at the Annual Conference of the American Educational Research Association, Washington, DC.
- Soffer-Goldstein, D., Pellegrino, J. W., Goldman, S. R., Stoelinga, T., Heffernan, N. T., Heffernan, C. L., & Dietz, K. (2016, April). *Improving mathematical learning outcomes through applying principles of practice and assessment with feedback*. Poster session presented at the Annual Conference of the American Educational Research Association, Washington, DC.
- Pellegrino, J., Heffernan, N., Goldman, S., Soffer-Goldstein, D., Stoelinga, T., & Heffernan, C. (2015, April). *Applying cognitive principles of "spacing" and "testing" in the context of a curriculum*. Symposium presentation at the Annual Conference of the American Educational Research Association, Chicago, IL.
- **Stoelinga, T.** (2015, May). *Finding the value: Students' investment in mathematics classroom discourse*. Invited poster session presented at the Social Policy and Research in Cognition and Mathematics Education: A Focus on the Common Core, 2015 Conference, Berkeley, CA.
- Stoelinga, T., Lynn, J. (2014, April). The power of discourse: Engaging underprepared students in rigorous algebra. Presentation at the Annual Conference of the National Council of Teachers of Mathematics, New Orleans, LA.
- Soffer-Goldstein, D., Pellegrino, J., Goldman, S., Stoelinga, T., Heffernan, N., Heffernan, C., Nair Das, V., & Dietz, K. (2014, April). *Improving long-term retention of mathematical knowledge through automatic reassessment and relearning*. Poster session presented at the Annual Conference of the American Educational Research Association, Philadelphia, PA.
- Lynn, J. & **Stoelinga, T.** (2013, October). *Reclaiming lost ground: Research-based interventions for underprepared algebra students.* Presentation at the NCTM Annual Regional Conference and Exposition, Baltimore, MD.
- Castro Superfine, A., Lynn, J., **Stoelinga, T.**, Martinez, M., Schneider, C., & Briars, D. (2013, April). *Supporting underprepared algebra students: Results from a design-based research program.* Invited symposium presentation for the annual meeting of the National Council of Teachers of Mathematics Research Presession, Denver, CO.
- Stoelinga, T., Briars, D., & Lynn, J. (2012, April). Architecture of intensification for underprepared algebra students. Conference paper presented at the Annual Conference of the American Educational Research Association, Vancouver, BC.

- **Stoelinga, T.** (2010, April). *A menu of strategies: Building flexible thinking into the curriculum.* Presentation at the Annual Conference of the National Council of Supervisors of Mathematics, San Diego, CA.
- Slaughter, R., Stoelinga, T., & Murff, R. (2005, April). Strategies for algebra support in Chicago Public Schools. Presentation at the Annual Conference of the National Council of Teachers of Mathematics, Anaheim, CA.

PROFESSIONAL SERVICE

2017	Proposal Reviewer, Psychology of Mathematics Education – North America (PME-NA 2017) Conference
2016	Proposal Reviewer, National Council of Teachers of Mathematics Research Conference
2016	Reviewer, South African Journal of Education
2015-2016	National Council of Teachers of Mathematics Classroom Resources Committee (NCTM-CRC), Reston, VA
2013-2014	Advisory Committee, Learning Sciences Research Institute, University of Illinois at Chicago
2013	Review Committee, Psychology of Mathematics Education – North America (PME-NA 2013) 2013 Conference, Chicago, IL
2011-2013	Conference Steering Committee, Psychology of Mathematics Education – North America (PME-NA 2013) 2013 Conference, Chicago, IL
2007	Review Committee, Colorado State Department of Education Title II Math/Science Partnership Grant Program
2004	Review Committee, Chicago Public Schools Renaissance 2010 Charter School Application Program

OTHER DISTINCTIONS

2015	National Academy of Education/Spencer Dissertation Fellowship Finalist
2017	Philip Wagreich STEM Education Award Recipient, UIC Learning Sciences Research Institute