MARGINALITY IN COLLABORATIVE GROUPS: A CULTURAL-HISTORICAL

ACTIVITY THEORY PERSPECTIVE

By

KARLYN R. ADAMS-WIGGINS

A Dissertation submitted to the

Graduate School-New Brunswick

Rutgers, The State University of New Jersey

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

Graduate Program in Education

written under the direction of

and approved by

Toni Kempler Rogat & Clark A. Chinn

_____

_____

_____

_____

New Brunswick, New Jersey

May, 2015

ABSTRACT OF THE DISSERTATION

Marginality in Collaborative Groups: A Cultural-Historical Activity Theory Perspective

by KARLYN R. ADAMS-WIGGINS

Dissertation Directors:

Dr. Toni Kempler Rogat
Dr. Clark A. Chinn

ABSTRACT

Recent research on collaborative learning demonstrates the importance of social aspects of groupwork for learning (e.g., Barron, 2003). Yet, a developmental lens on early adolescents' identity work during collaboration is absent. From a developmental perspective, both competence and contextualized peer relationships are critical for early adolescents' identities in middle school (Roeser & Eccles, 2000). Marginality situates identity within the context of development by emphasizing how students handle exclusion in groupwork. The present studies employed sociocultural and activity theoretical lenses to examine the unfolding of marginal identities in 7th grade classrooms at ethnically-diverse middle schools during three inquiry science units. Four questions were addressed: (1) how do group members negotiate competence during collaboration?, (2) how do marginal group members exercise agency?, (3) how do the forms of agency exercised by marginal group members relate to identity trajectories over a semester?, and (4) how does the structure of group activity systems contribute to the formation of marginal identities? Qualitative methods were used to analyze videotaped observations of groupwork and student interviews for Studies 1 and 2. Study 3 was a case study of outbound trajectories of marginality and activity system structures. Results of Study 1 indicate that group members negotiated competence in response to other-regulation. Study 2 produced a framework for marginality and agency; findings indicated that off-task activity was frequently used as a space to resist marginality and trajectories were best described by differences in number of alliances and flexibility of those alliances. Study 3 findings revealed that marginal identities were associated with contradictions

within rules that impacted the division of labor; division of labor was employed to exclude group members or invoke an intellectual/manual division of labor. Overall, results suggest that students need ways to access on-task activity without threats to competence. Further, sub-processes were identified that were involved in exerting agency even as the group negotiates exclusion and marginality. Findings suggest that professional development should focus on teachers supporting positive, central identities in groupwork and fostering group norms conducive to a psychologically safe climate. Students should also receive training on how to reduce their groups' focus on relative competence.

Dedication

This dissertation was made possible by a number of highly supportive people in my life and I would like to recognize their contributions to my scholarship. First, my parents have been a force in pushing me toward completion of my doctoral studies: thank you, Mom, for reminding me that I always have a home no matter what happens, and thank you, Dad, for reminding me that I should always do what I think is right, even if it's not popular. These life lessons have guided all of my decisions, no matter how much it seems like I didn't remember them. Second, my Granny and Pop-pop, my three sisters, and my Aunt Nay have supported me in their own special ways. Granny, Pop-pop, Aubre, Regina, Latoya, and Aunt Nay, you have been there when my life was getting crazy; you always reminded me that I had an extended family and we'd get through it all together. That extended family showed just how supportive they were when they came to Larry and I's wedding in 2012; you all reminded me how important we all are to each other. Likewise, Kourtney and Klara have been my sisters in soul even though we're only cousins by blood. Thanks for GETTING me!

I also want to recognize two of my closest friends at Rutgers, Ruth and Shanique, who helped me keep my head on straight and helped push me through spiritual ruts like no one else could. They, like the rest of my RUGCF family, Jean, Shonyce, and Tami helped keep me spiritually grounded; they have been my adoptive family. Another support I'd like to thank is Joan for being my last line of defense when I forgot my life's philosophy of "Did anyone die? No? Then it's all good". Additionally, I am thankful for the Sharon Baptist Youth Ministry kids, Rutgers Upward Bound kids, and Price Family Fellows at Rutgers for keeping me centered on my life's purpose of re-humanizing relationships in a dysfunctional society in any and every space that I have the opportunity

to occupy. Similarly, thank you to the Rutgers faculty union and my comrades all over the continent (if you're one of them, you'll know who you are) for reminding me of all the reasons why I cannot reject my life's purpose and why I can never lose when I am unapologetically and unequivocally on the side of the people. You all have helped me refine my understanding of world. Please continue to check me if I start thinking some nonsense now that I'm not a grad student! It's in writing, so I can't pretend I didn't ask.

Finally, I want to recognize the full-time, 1000% giving supporter of my endeavors, the one who saw how nuts I actually was during grad school (and didn't bail before it was too late), my best friend and lifelong partner, Larry. Larry, thank you so much for reminding me I'm not alone, even when I'm misunderstood; thank you for sharing my ridiculous sense of humor, even more ridiculous politics, as well as my atypically optimistic hope that the world can be better. Thanks for letting me know home is not a place, but a feeling everyone deserves to have by having their idiosyncrasies known and accepted as part of a whole human life. Thank you, Larry for understanding me well enough to know why I don't want to be called "doctor", why I have a soft spot for kids who others seem to think are a problem, and why I'm doing this academic thing in the first place. Thank you for knowing me well enough to grasp why I am who I am. Most importantly, thank you for reminding me that even if the so-called worst were to happen, we'd still have each other because we both are so committed to this. Thank you so much to everyone who allowed me to finish this project. No project is produced by a single pair of hands alone. You all have lifted me up and helped me even lift myself; this is your dissertation, too (even if you're like Shanique or Ruth and already wrote one).

TABLE OF CONTENTS

List of Tables

List of Illustrations

Chapter 1
Introduction

The literature on collaborative group work highlights the importance of social aspects of collaboration for students' successful group work. For example, there is an emphasis on the need for mutuality (e.g., Barron, 2000) and social regulation (e.g., Rogat & Linnenbrink-Garcia, 2011; Rogat & Adams-Wiggins, in press), the pitfalls of status hierarchies e.g., Cohen & Lotan, 1997), and the role of authority (e.g., Langer-Osuna & Engle, 2010). Yet, this research has not yet bridged to extant literature regarding adolescent development. As noted by Eccles and Roeser (2009), school is a context for adolescent development.

Early Adolescent Development, Motivation, and Identity

Students' relationships with each other are central to understanding social-emotional development in early adolescence. In their discussion of school as a developmental context for early adolescents, Roeser, Eccles, and Sameroff (2000) described social-emotional functioning in terms of adolescents' feelings of distress or well-being and their quality of relationships with peers. Juvonen (2007) elaborated the importance of students' sense of connectedness in middle school years for their engagement and prosocial behavior. Juvonen conceptualized connectedness as a sense of acceptance, respect, support and caring which is impacted by both relationships with teachers and relationships with classmates. Notably, Juvonen (2007) analyzed international data on early adolescents' sense of connectedness in school and found that middle school students in the United States feel more especially socially isolated and had greater perceptions of their classmates as unfriendly and unwilling to help each other

compared to peers in Israel and a set of European countries. Juvonen concluded that adolescents' sense of isolation and negative views of school are not cross-cultural universals and emphasized the need for pedagogical approaches that leverage adolescents' social motivation, foster a caring peer culture and emotional safety, and enhancing the continuity of students' educational experiences by having the same teacher for consecutive years.

Wang and colleagues (2013) share this emphasis on connectedness as they identified closeness and trust as "central in the prediction of emotional development and behavior problems" (p. 692). Other studies support Juvonen's recommendations to build upon of students' social motivation and foster of a caring peer culture that is emotionally safe. Ryan and Patrick (2001) observed four dimensions of the classroom social environment that were related to middle schoolers' motivation and engagement: promotion of mutual respect among classmates, promotion of interaction with peers on academic tasks, teacher support, and promotion of performance goals among classmates. Students who perceived that their teachers cared about and supported them as well as encouraged them to interact with others to share ideas reported engaging in less disruptive behavior than those who did not have these perceptions of their teachers. Students who perceived their teacher as encouraging mutual respect and social harmony reported higher self-regulation of school work, which Ryan and Patrick attributed to the possibility that students would experience less anxiety and thus increased cognitive engagement in a less threatening environment in which respect was promoted. Further, students who perceived their teachers as promoting performance goals, which emphasize

social comparison and competition among students, reported more engagement in disruptive behavior in class.

Ryan and Patrick's (2001) finding support Roeser and Eccles' (2000) conclusion that adolescents who perceive an emphasis on comparison, competition, and differential treatment by teachers are more likely to withdraw from school or engage in acting out behaviors. According to Eccles and Roeser (2011), these adolescent social needs are not merely coincidental but a matter of adolescent development: adolescents' social interactions are critical in the development of identities. One study supporting this perspective found that African-American students' experiences of racial discrimination at school from teachers and peers adversely affected academic outcomes, motivation, self-concept, and mental health, although a strong positive ethnic affiliation reduced the negative effects (Wong, Eccles, & Sameroff, 2003). In addition to the importance of ethnic and racial identities, gender is relevant to understanding the role of social interactions for students' adjustment in middle school. Wang and colleagues (2013) observed that positive experiences with teachers can serve as a buffer against misconduct for students experiencing negative family relationships. Wang (2009) specified that positive teacher-student relationships promote a sense of community and connectedness to the school for boys. The findings in these studies connecting student behavioral outcomes and motivation to identity strongly support the idea that middle schoolers' identities should be a focal point when researchers consider the role of the social side of middle schoolers' experiences.

Importantly, social aspects of schooling may be responsible for many of the challenges in schooling for early adolescents, despite the challenges often being framed

as primarily cognitive issues, such as cognitive engagement or classroom management. Indeed, Eccles and Roeser (2011) claim that the motivational challenges faced by early adolescents in the transition from elementary to middle school are primarily a problem of developmentally-inappropriate changes in schooling. Eccles and colleagues (1993) argue that developing adolescents need a proper stage-environment fit, as is presumed in stage-environment fit approach (Eccles & Midgley, 1989). Eccles and colleagues (1991) identified autonomy-unsupportive environments in both the school and home as yet another feature of developmentally-inappropriate changes adolescents face.

Overall, there is a great deal of research outlining the importance of adolescents' social lives and their need for supportive social interactions during the middle school years. This research generally suggests that negative academic outcomes which appear to be primarily cognitive in nature may actually require socially-oriented remedies. Early adolescents spend the vast majority of their day inside of a school with peers and authority figures with whom they connect primarily around school-based activities. For researchers concerned with understanding students' motivation in middle school, a focus on development not only offers insight into the motivational changes observed at the middle school transition, but it also reminds us of the what Erikson deemed a critical developmental task in adolescence that is likely to bear on students' motivation: establishing one's identity. Eriksonian conceptualizations of adolescent identity are among the most common found in developmental psychology and focus on identity statuses and identity formation as central concepts (Côté & Levine, 2002). The focus on identity formation and the status of identity achievement lend well to understanding adolescents' exploration of career options, but pose challenges when attempting to

explain identities that have a less definitive endpoint, such as ethnic identity or more broad self-perceptions.

In light of challenges in applying Eriksonian conceptualizations of identity to explain social-emotional development, models of identity as negotiated can be appealing: instead of highlighting the stability of identity, they can be used to examine the fluid aspects of identity in adolescence (e.g. Holland et al., 1998). Whereas the identity statuses model addresses how a person arrives at a coherent or integrated sense of self, negotiated models tend to emphasize the interplay between the individual and the social context in a co-construction of an understanding of who one is (Faircloth, 2012). Further, the focus on co-construction in negotiated models means the choices of others in the social context become a focal point for understanding the identity of the individual. Thus, negotiated models have relevance when researchers are examining adolescent identity with a focus on peer relationships in school and when researchers are seeking to understand the role of adolescents' social lives and self-perceptions in their motivation for school. Adolescents' social interactions in school come to bear on their self-perceptions in ways that are relevant for motivation, as in the case of adolescents' views of their academic abilities. Ryan and Patrick's (2001) findings regarding middle schoolers' perceptions of teachers as promoting performance goals already alluded to the importance of competence-relevant social comparisons for adolescents' motivation. For students during early adolescence a sense of being a competent contributor in the classroom is likely to be central and also is likely to be an important part of negotiated identity.

Positioning Competence as Central in Middle Schoolers' Identity and Motivation

The extensive body of literature regarding the role of competence for students' achievement motivation offers insight into how competence may be relevant for socioemotional development in collaborative learning contexts. With regards to outcomes related to competence beliefs, the achievement goal theory literature emphasizes the importance of how competence is defined, either relative to others in a social comparison (performance goals) or in relation to an absolute criterion or an internal comparison (mastery goals). Findings generally support the superiority of mastery goals for students in collaborative learning contexts: students with mastery goals are more willing to work with peers who are perceived as different, choose partners based on how well they will learn rather than to enhance their own social status, persist through challenges, exhibit cognitive engagement and deep processing of content, use metacognitive strategies and manage effort, seek help, and view classmates as supporters of learning rather than competitors (Midgley, Kaplan, & Middleton, 2001; Levy, Kaplan, & Patrick, 2004; Wolters, 2004; Ryan & Pintrich, 1997; Grant & Dweck, 2003; Linnenbrink & Pintrich, 2000; Pintrich & De Groot; 1990; Graham & Golan, 1991; Darnon et al., 2006). Thus, the findings imply that a de-emphasis of social comparison (i.e. performance goals) and an emphasis of task-focused goals (i.e. mastery goals) would be beneficial, as Ryan and Patrick's (2001) study of student-teacher relationships also highlighted.

There are numerous ways students' self-perceptions of competence have been measured and addressed in the motivation literature. Three major ways competence has been conceptualized for study are the need for competence, self-efficacy, and academic

self-concept or perceived competence. Each of these three approaches comes from a different theoretical grounding. Yet, academic self-concept is the most fitting backdrop for developing a socioculturally-oriented conception of marginality and it is therefore the most appropriate for framing this study of marginality in collaborative learning contexts. The first of the three conceptions of competence is found in self-determination theory (SDT). In SDT, competence is conceptualized as one of three basic human needs that drives all intrinsically motivated behavior. *Need for competence* is framed as an innate and universal human need emerging from human evolution (Baard, Deci, & Ryan, 2004; Deci & Ryan, 2004). While a need for competence may fit well with the extant literature on adolescent development and schooling because competence indeed does appear to be a need and does seem to be fairly universal, the conceptualization of competence as a universal need has limitations in the context of this study. Here, the focus is on how students develop marginal identities and it is of interest to understand cases where competence seems at least superficially to be irrelevant for a student, such as a student who disidentifies with school. For the purposes of the present study, a need for competence cannot be understood as "natural" or inevitable.

The second and third conceptions of competence that comes from social cognitive theory and self theories respectively and are known as self-efficacy and academic self-concept. *Self-efficacy* refers to one's perceptions of his or her ability to perform at a given level of proficiency on a task (Schunk & Pajares, 2005). Since self-efficacy is task-specific, self-efficacy levels are malleable, with four key influences being mastery experiences, vicarious experience, social persuasion, and emotional arousal (Bandura, 1977). Self-efficacy as a construct emphasizes the cognitive aspects of competence's

relevance for motivation: the construct focuses on people's ability to self-evaluate and form beliefs about their own ability. Beliefs like self-efficacy are understood as often mattering more than "what is objectively true" (Schunk & Pajares, 2005, p.86).

Further, self-efficacy is a future-oriented belief, as it is focused on how strongly one beliefs he or she can perform well on a task (Bong & Skaalvik, 2003). *Academic self-concept* is the knowledge and perceptions one has about oneself in academic contexts and is subordinate to the broader construct of general self-concept (Marsh, Byrne, & Shavelson, 1988). Unlike self-efficacy, academic self-concept includes emotional and self-worth components (Bong & Clark, 1999). Further, academic self-concept has traditionally been measured in ways that emphasize social comparison (Bong & Clark, 1999). Thus, while self-efficacy can be impacted by features of the social context in the short term by verbal persuasion and vicarious experiences, academic self-concept is a more enduring construct that is impacted by significant others and social comparisons (Bong & Skaalvik, 2003). As Bong and Skaalvik noted, academic self-concept can be affected by internal comparisons (i.e. comparisons regarding one's own progress over time), whereas self-efficacy is more focused on whether a person is capable of succeeding in a specific task at a single time. Because of the past-oriented nature of academic self-concept and its capacity for internal as well as social comparisons, academic self-concept lends well to examinations of negotiated identity development over time in school.

Marginality: A Sociocultural Perspective on Identity and Social Isolation for Adolescents

Taken together, the literatures on the role of school in adolescent development and students' achievement motivation highlight negotiated identity and competence as increasingly relevant for students as they move into middle school during early adolescence. Prior research discussing academic status hierarchies in the classroom has done a great deal to help us understand how competence and social identities emerge for students (Cohen, 1994; Lotan, 2003; Bianchini, 1999). Yet, research on academic status hierarchies is problematic if we seek to employ a sociocultural perspective for an analysis in which adolescents' interaction with the physical and social environment take primacy. Specifically, in status hierarchies research, the focus has traditionally been on describing what happens to students identified as low-status and less attention has been given to how students become low-status in the first place. Language chosen to describe these situations may also be part of the problem: using the language of "exclusion" presents social isolation as externally-imposed and non-negotiable. It fails to address instances in which marginal students are actually engaging in resistance and normalizes inequities by preventing us from asking questions of *why* when resistance does not seem to work (Gannon & Davies, 2012; Magnusson & Marecek, 2010, Wortham, 2004; Hand, 2010).

The omission of accounts of low-status students' agency may be due to a challenge of avoiding the pitfall of *deficit thinking* (Valencia & Solórzano, 1997). Deficit-oriented approaches fail to account for the role of institutional and structural influences in explaining the student or group of students' suboptimal learning outcomes; the successful focus on institutional influences has been a strong point of status hierarchies research (Valencia & Black, 2002). More recent research often takes a similar

approach of emphasizing the role of structural and institutional influences, but in order to take a sociocultural lens the analysis focuses on interactions in the classroom and discourse (e.g. Wortham, 2004; Hand, 2010; Nasir & Hand, 2008; Boaler, 2008; Leander, 2002).

Models of identity as negotiated and positional or relational can be helpful for addressing the questions of how status emerges as these models heavily emphasize discursive interactions and focus on treating disadvantaged individuals as having agency while also attempting to theorize the role of structural constraints on agency. *Marginality* is a term that has been employed to describe the state of low-status as a negotiated process of social exclusion and is therefore helpful in understanding how all parties contribute to the construction of socially excluded identities. Unfortunately, research has honed in on interaction as the unit of analysis while simultaneously under-theorizing socially isolated students' resistance and agency within the classroom itself.

In one deviation from this larger pattern, equity-oriented research on critical science agency has achieved a focus on students' agency while simultaneously addressing structure; this was achieved by defining agency as a direct response to structures that disenfranchise (e.g. Barton & Tan, 2012). The definition of agency as a response to disenfranchisement is critical if we are to avoid the pitfall of deficit-thinking: when zooming in to focus on local social interactions, structure becomes invisible if it is not captured within the understanding of agency put forth. Thus, to fully understand the negotiation of participation and power relations within collaborative groups while rejecting erroneous deficit-oriented frameworks, we must account for both the dynamic and the enduring aspects of historically and socially contextualized interactions.

Nonetheless, the existing models of marginality are limited in a number of ways. Recent approaches focusing on identity in practice help us avoid essentialist models of identity and lend to recognizing agency of those in marginal positions, but if we seek to improve equity in schools we must simultaneously address the societal structures that shape students' experiences (Nasir & Saxe, 2003; Gutiérrez & Rogoff, 2003; Valencia & Solórzano, 1997). Thus, two key needs emerge presently: the need for a developmental lens on social exclusion and social identity in middle school and the need for a sociocultural lens on identity in which identity is understood as negotiated. In the present studies, a framework sensitive to early adolescent social-emotional development for understanding middle schoolers' identities in inquiry science classrooms will be elaborated.

As findings regarding motivation in middle school also demonstrate, studies of students' marginality also emphasize the negative impact of social isolation on academic outcomes, specifically opportunities to participate (Esmonde, 2009). The abundance of studies highlighting the emergence of marginal identities in the classroom posit marginality as an outcome of various group social processes, as well: student authority (Langer-Osuna & Engle, 2010), work practices (Esmonde, 2009), positioning (Langer-Osuna, 2011), relational equity (Boaler, 2008), small group interactions (Barron, 2003; Cornelius & Herrenkohl, 2004; Kurth et al., 2002), and other-regulation (Adams-Wiggins & Rogat, 2014). Nonetheless, research focused on motivationally-relevant constructs like competence is currently lacking.

The Present Study: Toward a Developmental Conception of Middle Schoolers' Identities

A view of identity as socially-constructed in a historical context is necessary to address questions regarding the nature of marginality. From this perspective, marginality should be treated as: (1) a dynamic and negotiated positional identity emerging out of collective activity, (2) having the potential to be short- or long-term in light of opportunities to exercise agency, and (3) being relevant to the self-perceptions due to the centrality of competence and schooling in middle schoolers' lives. Cultural-historical activity theory (CHAT) is a promising lens for successfully addressing the role of history at both the short- and long-term levels as well as successfully providing a fuller account of how agency evolves for those in marginal positions. While multiple socioculturally-oriented frameworks for studying identity construction exist, it is important to note that they are not interchangeable as they bring different theoretical assumptions (Kirschner & Martin, 2010).

For example, more discourse-centered approaches, such as positioning theory, attend to the issue that skills, knowledge, or ability do not always determine individual's contributions to shared endeavors by invoking the distribution of rights and duties to actors via discursive positioning acts that create storylines (Langenhove & Harré, 1999). Positioning theory is concerned with "revealing the explicit and implicit patterns of reasoning that are realized in the ways that people act towards others" and the "local moral domain"; further, it is based on the principle that psychology should study meaning-making (Harré et al., 2009, pp. 5-6). Nonetheless, the framework focuses primarily on discourse and less so on material resources in the social context. Another sociocultural framework, cultural-historical activity theory (CHAT), on the other hand,

extends Vygotsky's focus on speech and language in human development to attend to practical activity understood as evolving historically (Cole et al., 1978; Roth & Lee, 2007). The issue of long-term history is explicitly addressed in CHAT as the theory is developmental in its origins and all local activity is understood as involving mediating artifacts that were formed historically and serve as cultural resources for larger society (Engeström & Miettinen, 1999).

Thus, CHAT is oriented to long- and short-term history from the outset; positioning theory, while offering a valuable set of tools for addressing short-term history, requires more effort to explain the connection to long-term history. In addition to this advantage of CHAT, two other key features of CHAT lend well to addressing the problem of studying marginality and help historicize the development of marginal identities: (1) its systematic identification and inclusion of entities in activity systems that contribute to activity and shape the actions of individuals and (2) its emphasis on human agency at both the individual and collective levels. Therefore, the present study aimed to expand our understanding of marginality utilizing a CHAT perspective to study small collaborative groups in an inquiry learning context. The study contributes to the literatures on collaborative learning as well as on marginality by offering a framework that captured both the fluidity and the historicity of marginality; this was done by examining the social construction of marginal identities in-depth from multiple angles in three separate studies. The following research questions were addressed using qualitative methods across the three studies:

1. How do forms of other-regulation employed in a collaborative inquiry science context relate to how competence is negotiated by group members? (Study 1, focus on individuals-within-groups)

2. How do marginal group members exercise agency in a collaborative inquiry science context? (Study 2A, focus on acts by individuals within a group)

3. What is the relationship between the forms of agency exercised by marginal group members and their trajectories of marginality over the course of a semester? (Study 2B, focus on marginal individuals within groups)

4. How are activity systems structured in groups where long-term marginality (i.e. marginal identity) emerges? (Study 3, focus on activity system)

In Study 1, the negotiation of competence in inquiry science collaboration was explored in order to establish the relevance of competence for students' inclusion and exclusion during groupwork. Negotiation of competence was examined from two angles: group members' positioning of themselves and the group as a whole's affirmation or rejection of individual group members' positioning efforts. The analysis of competence negotiation in Study 1 was grounded in Altermatt and colleagues' (2002) evaluative discourse framework and Gresalfi and colleagues' (2009) systems of competence framework. Study 1 also offers an explication of the interactional moves middle school students use during inquiry science collaboration to negotiate competence for themselves and their groupmates.

In Study 2, frameworks for both marginal identities and agency in middle school inquiry science collaboration were constructed. The aims of Study 2 goes beyond positing competence as negotiated at the group level to address the identities students construct as they become further included or excluded during groupwork over a semester. Study 2 also offers a rich description of marginal group members as agentic rather than passive or invisible by describing the acts they use in response to their own marginality. Study 2 aimed to de-privilege students' relationships with academic content in defining agency and reorient the focus toward students' relationships with peers.

Finally, Study 3 addressed the structure of activity systems in which long-term marginal identities were observed for students. Extending from Study 2's analysis of individual group members' acts of agency and trajectories of marginality over the semester, Study 3 offered an account of the constraints on marginal group members' agency in an inquiry science context. A subsample of three groups from Study 2 was selected for a case study of the ways that small groups' norms enable groups to constrain marginal group members' agency.

As a set of studies viewed holistically, the three studies here extend previous research on status problems in groupwork and aid in highlighting the relevance of social-emotional development in collaborative learning during middle school. One of the larger goals here is to enhance our understanding of how inequity emerges within collaborative groups through the study of how marginality can be disrupted or normalized in activity. By addressing the problem with the three studies presented here, it is possible to shift between different planes of analysis and view students' agency as contextualized.

References

Altermatt, E. R., Pomerantz, E. M., Ruble, D. N., Frey, K. S., & Greulich, F. K. (2002). Predicting changes in children's self-perceptions of academic competence: A naturalistic examination of evaluative discourse among classmates. *Developmental Psychology*, *38*(6), 903.

Baard, P. P., Deci, E. L., & Ryan, R. M. (2004). Intrinsic Need Satisfaction: A Motivational Basis of Performance and Weil-Being in Two Work Settings. *Journal of Applied Social Psychology*, *34*(10), 2045-2068.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*, *84*(2), 191.

Barron, B. (2000). Achieving coordination in collaborative problem-solving groups. *The Journal of the Learning Sciences, 9*(4), 403-436.

Barron, B. (2003). When smart groups fail. *The Journal of the Learning Sciences*, *12*(3), 307-359.

Barton, A. C., & Tan, E. (2010). We be burnin'! Agency, identity, and science learning. *The Journal of the Learning Sciences*, *19*(2), 187-229.

Bianchini, J. A. (1997). Where knowledge construction, equity, and context intersect: Student learning of science in small groups. Journal of Research in Science Teaching, *34*(10), 1039-1065.

Boaler, J. (2008). Promoting 'relational equity' and high mathematics achievement through an innovative mixed-ability approach. British Educational Research Journal, *34*(2), 167-194.

Bong, M., & Clark, R. E. (1999). Comparison between self-concept and self-efficacy in academic motivation research. *Educational psychologist*, *34*(3), 139-153.

Bong, M., & Skaalvik, E. M. (2003). Academic self-concept and self-efficacy: How different are they really?. *Educational psychology review*, *15*(1), 1-40.

Cohen, E. G. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research*, *64*(1), 1-35.

Cole, M., John-Steiner, V., Scribner, S., & Souberman, E. (1978). *L.S. Vygotsky: Mind in society, the development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Cornelius, L. L., & Herrenkohl, L. R. (2004). Power in the classroom: How the classroom environment shapes students' relationships with each other and with concepts. *Cognition and Instruction, 22*(4), 467-498.

Côté, J.E., & Levine, C.G. (2002). *Identity, formation, agency, and culture: A social psychological synthesis*. Mahwah, NJ: Lawrence Erlbaum Associates.

Darnon, C., Muller, D., Schrager, S. M., Pannuzzo, N., & Butera, F. (2006). Mastery and performance goals predict epistemic and relational conflict regulation. *Journal of Educational Psychology*, *98*(4), 766.

Davies, B., & Harré, R. (1990). Positioning: The discursive production of selves. *Journal for the Theory of Social Behaviour, 20*(1), 43-63.

Eccles, J. S., & Midgley, C. (1989). Stage-environment fit: Developmentally appropriate classrooms for young adolescents. *Research on motivation in education*, *3*, 139-186.

Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., & Mac Iver, D. (1993). Development during adolescence: the impact of stage-environment fit on young adolescents' experiences in schools and in families. *American psychologist*, *48*(2), 90.

Eccles, J. S., Buchanan, C. M., Flanagan, C., Fuligni, A., Midgley, C., & Yee, D. (1991). Control versus autonomy during early adolescence. *Journal of Social Issues*, *47*(4), 53-68.

Eccles, J. S., & Roeser, R. W. (2011). Schools as developmental contexts during adolescence. *Journal of research on adolescence*, *21*(1), 225-241.

Eccles, J. S., & Roeser, R. W. (2009). Schools, academic motivation, and stage-environment fit. *Handbook of adolescent psychology*.

Eccles, J. S., Wigfield, A. & Schiefele, U. (1998). Motivation to succeed. Damon, William, Eisenberg, Nancy [Ed]. Handbook of child psychology, 5th ed.: Vol 3. Social, emotional, and personality development. Hoboken, NJ, US: John Wiley & Sons Inc, US; pp. 1017-1095.

Engeström, Y., & Miettinen, R. (1999). Introduction. In Y. Engeström, R. Miettinen & R. Punamaki (Eds.), *Perspectives on activity theory* (pp. 1-18). USA: Cambridge University Press.

Esmonde, I. (2009). Mathematics learning in groups: Analyzing equity in two cooperative activity structures. *The Journal of the Learning Sciences, 18*(2), 247-284.

Faircloth, B. S. (2012). "Wearing a mask" vs. connecting identity with learning. *Contemporary Educational Psychology*, *37*(3), 186-194.

Gannon, S., & Davies, B. (2012). Postmodern, post-structural, and critical theories. In S.

N. Hesse-Biber (Ed.), *Handbook of Feminist Research: Theory and Praxis* (2nd ed., pp. 65-91). Washington DC: Sage.

Graham, S. & Golan, S. (1991). Motivational influences on cognition: Task involvement, ego involvement, and depth of processing. *Journal of Educational Psychology, 83,* 187-194.

Grant, H. & Dweck, C. (2003). Clarifying achievement goals and their impact. *Journal of Personality and Social Psychology, 85(3),* 541-553.

Gresalfi, M., Martin, T., Hand, V., & Greeno, J. (2009). Constructing competence: An analysis of student participation in the activity systems of mathematics classrooms. *Educational Studies in Mathematics, 70*(1), 49-70.

Gutiérrez, K. D., & Rogoff, B. (2003). Cultural ways of learning: Individual traits or repertoires of practice. *Educational Researcher, 32*(5), 19-25.

Hand, V. M. (Mar 2010). The co-construction of opposition in a low-track mathematics classroom. *American Educational Research Journal, 47*(1), 97-132.

Harré, R., & Van Lagenhove, L. (1999). Positioning theory: Moral contexts of international action. Malden, MA: Blackwell Publishers.

Holland, D., Lachicotte, W. J., Skinner, D., & Cain, C. (1998). *Identity and agency in cultural worlds*. Cambridge, MA: Harvard University Press

Juvonen, J. (2007). Reforming middle schools: Focus on continuity, social connectedness, and engagement. *Educational Psychologist*, *42*(4), 197-208.

Kirschner, S. R., & Martin, J. (2010). The sociocultural turn in psychology: An introduction and an invitation. In S. R. Kirschner & J. Martin (Eds.), *The sociocultural turn in psychology: The contextual emergence of mind and self* (pp. 1-27). New York, NY, US: Columbia University Press.

Kurth, L. A., Anderson, C. W., & Palincsar, A. S. (2002). The case of Carla: Dilemmas of helping all students to understand science. *Science Education, 86*(3), 287-313.

Langer-Osuna, J. M. (2011). How Brianna became bossy and Kofi came out smart: Understanding the trajectories of identity and engagement for two group leaders in a project-based mathematics classroom. *Canadian Journal of Science, Mathematics and Technology Education, 11*(3), 207-225.

Langer-Osuna, J. M., & Engle, R. A. (2010). I study features; believe me, I should know!: The mediational role of distributed expertise in the development of student authority. *Proceedings of the 9th International Conference of the Learning Sciences*, Chicago, IL.

Leander, K. M. (2002). Locating Latanya: The situated production of identity artifacts in classroom interaction". Research in the Teaching of English, *37*, 198-250.

Levy, I., Kaplan, A., & Patrick, H. (2004). Early adolescents' achievement goals, social status, and attitudes towards cooperation with peers. *Social Psychology of Education*, *7*(2), 127-159.

Linnenbrink, E.A. & Pintrich, P.R. (2000). Multiple pathways to learning and achievement: *The role of goal orientation in fostering adaptive motivation, affect, and cognition*. Sansone, C., & Harackiewicz, J.M. (Eds.). Intrinsic and extrinsic motivation: The search for optimal motivation and performance. San Diego, CA, US: Academic Press

Lotan, R. A. (2003). Group-worthy tasks. *Educational Leadership, 60*(6), 72-75.

Magnusson, E., & Marecek, J. (2010). Sociocultural means to feminist ends: Discursive and constructionist psychologies of gender. In S.R. Kirschner, & J. Martin (Eds.), *The sociocultural turn in psychology: The contextual emergence of mind and self* (pp. 88-110). New York, NY, US: Columbia University Press.

Marsh, H. W., Byrne, B. M., & Shavelson, R. J. (1988). A multifaceted academic self-concept: Its hierarchical structure and its relation to academic achievement. *Journal of educational psychology*, *80*(3), 366.

Midgley, C., Kaplan, A., & Middleton, M. (2001). Performance-approach goals: Good for what, for whom, under what circumstances, and at what cost? *Journal of Educational Psychology, 93*(1) , 77-86.

Nasir, N. S., & Hand, V. (2008). From the court to the classroom: Opportunities for engagement, learning, and identity in basketball and classroom mathematics. *The Journal of the Learning Sciences, 17*(2), 143-179.

Nasir, N. S., & Saxe, G.B. (2003). Ethnic and academic identities: A cultural practice perspective on emerging tensions and their management in the lives of minority students. *Education Researcher, 32*(5), 14-18.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of educational psychology*, *82*(1), 33.

Rogat, T.K. & Adams-Wiggins, K.R. (in press). Facilitative versus directive other-regulation in collaborative groups: Implications for socioemotional interactions. *Computers in Human Behavior.*

Rogat, T.K., & Adams-Wiggins, K.R. (2014). Other-regulation in collaborative groups:

Implications for regulation quality. *Instructional Science,* 1-26.

Rogat, T.K. & Linnenbrink-Garcia, L. (2011) Socially shared regulation in collaborative

groups: An analysis of the interplay between quality of social regulation and group processes. *Cognition and Instruction, 29*(4), 375-415.

Roeser, R. W., Eccles, J. S., & Sameroff, A. J. (2000). School as a context of early

adolescents' academic and social-emotional development: A summary of research findings. *The Elementary School Journal*, 443-471.

Ryan, A. M., & Patrick, H. (2001). The classroom social environment and changes in

adolescents' motivation and engagement during middle school. *American Educational Research Journal*, *38*(2), 437-460.

Ryan, A. M. & Pintrich, P. R. (1997). "Should I ask for help?" the role of motivation and

attitudes in adolescents' help seeking in math class. *Journal of Educational Psychology, 89*(2) , 329-341.

Roth, W.M., & Lee, Y. (2007). "Vygotsky's neglected legacy": Cultural-historical activity theory. *Review of Educational Research, 77*(2), 186-232.

Schunk, D. H., & Pajares, F. (2005). Competence perceptions and academic functioning. In A. J. Elliot & C. S. Dweck (Eds.), Handbook of competence and motivation (pp. 85–104). New York: Guilford Press.

Valencia, R. R. & Solórzano, D.G. (Eds.). (1997). *The evolution of deficit thinking: Educational thought and practice.* Bristol, PA: The Falmer Press.

Valencia, R. R., & Black, M. S. (2002). "Mexican Americans don't value education!"— On the basis of the myth, mythmaking, and debunking. *Journal of Latinos and Education, 1*(2), 81-103.

Wang, M. T. (2009). School climate support for behavioral and psychological adjustment: Testing the mediating effect of social competence. *School Psychology Quarterly*, *24*(4), 240.

Wang, M. T., Brinkworth, M., & Eccles, J. (2013). Moderating effects of teacher–student relationship in adolescent trajectories of emotional and behavioral adjustment. *Developmental psychology*, *49*(4), 690.

Wolters, C. (2004). Advancing achievement goal theory: Using goal structures and goal orientations to predict students' motivation, cognition, and achievement. *Journal of Educational Psychology, 96*(2*),* 236-250.

Wong, C. A., Eccles, J. S., & Sameroff, A. (2003). The influence of ethnic discrimination and ethnic identification on African American adolescents' school and socioemotional adjustment. *Journal of personality*, *71*(6), 1197-1232.

Wortham, S. (2004). From good student to outcast: The emergence of a classroom identity. *Ethos, 32*(2), 164-187.

Chapter 2: Study 1 - Variation in Other-Regulation and the Implications for Competence Negotiation

Introduction

Successful teamwork is increasingly necessary for learning in and beyond school (Strijbos, Kirschner & Martens, 2004). To succeed, groups need skills for jointly coordinating and regulating work on a shared task product. Recent research has expanded prior emphases on individual self-regulated learning to consider the contextualized nature of students' experiences during group work, with the ultimate aim of understanding group's regulation of behavior, learning, and understanding during shared activity (Volet, Vauras & Salonen, 2009). Social regulation research has focused on who is regulating within the group indicating a range from other-regulation or coregulation, in which one student temporarily predominates the group's interactions, to socially shared regulation, whereby multiple group members jointly regulate group activity (Vauras, Iiskala, Kajamies, Kinnunen, & Lehtinen, 2003). While other-regulation is typically conceptualized as a leader temporarily facilitating other's understanding (Hadwin & Oshige, 2011), there is some evidence that other-regulation may be stable once a group leader is established (Li, et al., 2007) and more directive in conducting the regulatory processes for the group (Rogat & Linnenbrink-Garcia, 2011). Rogat and Linnenbrink-Garcia's (2011) results described *directive other-regulation* as one group members' efforts at determining the next step of the task, detailing exactly what group members should do, and maintaining control of monitoring and task contributions. These findings indicate that there may be a broader spectrum of other-regulatory behaviors that go beyond facilitation to include more dominant forms. Beyond more clearly

understanding the nature of how leaders regulate in collaborative groups, it is also critical to understand the implications for group process. Research indicates some evidence that, in contrast to facilitative regulation, directive forms can provoke conflict in reaction to followers' regulation being ignored, with limited means for contributing to the task (Rogat & Linnenbrink-Garcia, 2011). Followers may also come to experience their participation as peripheral and in conflict with the leader, particularly when their regulatory and content contributions are not integrated. This lies in comparison to groups engaging in a facilitating form of other-regulation in which disagreement is experienced as promoting co-constructed meaning and task improvement.

The current study has two goals. First, we examine other-regulation within collaborative groups to more richly understand the regulatory processes employed by dominant and facilitating other-regulators. Towards this end, we designate each group's other-regulator by examining frequency and types of strategies employed by all members of the group, using distinctions made in prior research, such as regulation of content understanding, use of disciplinary norms, task process, group process, and behavior (e.g. Hogan, Nastasi & Pressley, 1998; Rogat & Linnenbrink-Garcia, 2011; Salonen, Vauras & Efklides, 2005). We also qualitatively examine these social regulatory processes to more richly characterize the nature of the employed other-regulation. Understanding variation in other-regulation is critical since in dominant and directive forms, regulation of the group may be low quality and limit equitable involvement in ways that convey information about group members' competence.

A second goal of the research is to investigate the relationship between variation in other-regulation and group process. In particular, we explore how other-regulation

impacts efforts by group members to negotiate their own and/or others' positions of competence. In the context of dominant other-regulation, followers may perceive a threat to their competence when their regulation and content contributions are ignored or treated as irrelevant (i.e., conflict), which could introduce doubt about relative competence (Darnon, et al., 2006). In response to relative ability being made salient and questioning the competency of one's own contributions, group members may engage in competence negotiation. For groups with facilitative other-regulators, leaders may correspondingly work to ensure everyone ideas are solicited, fostering inclusion and respect for everyone's capable contributions, thus reducing the need to negotiate relative competence.

In this work, we conceptualize competence negotiation using the literature on social comparison to investigate how individual students work to reposition themselves and their peers within the system of competence (Altermatt, et al., 2002; Gresalfi et al., 2009). Toward this end, we examine how individuals within the group work to ensure that their ideas are not ignored, are considered for integration, and defend their own capabilities by *self-advocating* or *self-presenting*. We also explore whether there are moves to reposition others as more or less competent by promoting and supporting, or being highly critical of, other's contributions (i.e., *other-positive* or *other-negative*). Fundamentally, it is critical to consider implications of other-regulation, since social comparison can have negative consequences for group functioning. The focus on relative competence promoted by dominant forms of other-regulation may ultimately discourage a shared focus on learning from the task (Ames, 1992), with implications for diminished

conceptual understanding during collaborative tasks given the social nature of joint activity (Barron, 2000).

Method

Three 4-person groups of 7th grade students were observed during two inquiry-based science tasks focused on cell organelles and the development of reasoning skills. Groups were purposefully selected based on differences in other-regulation; we sought to examine strong examples of the phenomena of interest without including extreme cases. Two observations per group were selected using these criteria: observations involved a collaborative task (excluding pair work and heavy teacher-led talk), lasted at least five minutes, and off-task behavior was minimal.

Video-taped observations were transcribed. Next, we identified instances of social regulation. Then, sub-codes were applied to differentiate regulatory types (see Table 1), and each instance was designated as taken up, ignored, or rejected with or without rationale (Barron, 2000). Frequencies and percentages were calculated for participation, regulatory moves, and responses to regulation. Other-regulators were identified by their frequent regulatory contributions relative to their group members as well as their use of a broad range of types of social regulation. Subsequent qualitative analysis into the regulation employed by these leaders informed our designations of the type of other-regulation as facilitative or dominant regulation. We also coded for evidence of competence positioning in response to raised doubts regarding one's own or others' capable and valued contributions within the group. Through *competence positioning* individuals can work to negotiate perceptions of their own competence or that of others to contribute toward the shared product through efforts at enhancement or

diminishment of perceived competence (see Table 1). Individuals within the group can attempt to convey that they are capable contributors via self-advocating or self-presentation (i.e., self-positive). Competence negotiation can also be targeted toward one's group members in efforts to promote and advocate for other's contributions (i.e., other-advocate and other-positive) or by diminishing the competence of one's teammate (i.e., other-negative). Also, in response to criticism, group members may reflect these efforts to diminish competence via self-deprecation (i.e., self-negative). Further, groups who focus on relative ability may shift between discussing ability within the group to discussing between-group ability comparisons (i.e., group positive and group negative) (Kempler & Linnenbrink, 2004). Both overt (e.g., I am smart) or subtle (e.g. refusing or soliciting help from a particular group member) evaluative statements were included as evidence of competence positioning given findings that older children offer overt praise and criticism less often, while more typically engage in subtle forms of social comparison (Altermatt et al., 2002). After coding the observations, reliability was established and disagreements were resolved to yield final codes.

Results

We began by exploring differences in other-regulation among the groups by examining equitableness in the amount of talk students contributed to discussion using percentage of total turns taken by each group member (Hogan, et al., 1999). Results confirmed the variation in other-regulation in line with our purposeful sampling of groups (see method and Table 2). In Group 1, all four students participated relatively equally during group discussion, which could be representative of shared-regulation or facilitative other-regulation. Group 2 and 3 showed more inequitable or unbalanced

contributions among group members, with both groups having one dominant member. Group 2 was differentiated by having one group member who evidenced very limited participation, while Group 3's remaining group members showed more equal participation. To identify the other-regulation, we also examined frequencies of total regulation, the range, and the tally of regulation types employed by members of the group (see Table 2). Below we characterize the nature of each group's other-regulation given these frequency data and a qualitative analysis of the how the leader engaged in regulatory processes for the group.

Variation in Other-Regulation

Donna was identified as Group 1's other-regulator: she engaged more frequently and broadly than her groupmates in all forms of social regulation, with the exception of content regulation in which her frequencies were representative of her group. Donna's other-regulation can be characterized as facilitating; she regularly posed task regulation questions to evoke widespread participation (e.g. "This evidence, okay well how does it relate to the movement and energy models?"), brought the group back to task (e.g. asking "What'd you guys write this as?" during off-task behavior), and regulated group process in ways that prevented exclusion of Bob's minority perspective on Task 1 (e.g. "Now we're gonna add 'How would you rate this, Bob?'"). Donna also kept the group accountable to the class' jointly created disciplinary criteria by referencing the norms during discussion (e.g. "The most important thing of good evidence is if it's relevant. If it's irrelevant, it's not good."). Allison also made regulatory moves frequently in Group 1, but she most heavily regulated group process and disciplinary practice, with her group regulation primarily focused on turn order. Bob and Cindy both regulated less often

overall, but also tended to regulate group process. Overall, all group members were able to equitably inform knowledge construction during the two tasks, and it was Donna's facilitating other-regulation that appeared to foster this widespread inclusion and integration of ideas.

Group 2's participation was skewed and involved directive other-regulation by Carla and David. Carla and David's regulation was directive and focused on task and content, with many moves involving directive statements (e.g. David's "Add it up!"; Carla's "Get a calculator"). Further, David and Carla's directive regulation was minimally focused on content and rarely included rationales, but rather focused on simply besting one another. David and Carla battled for control over whose regulation and positions would ultimately be represented in the group product. In one example where the task required discussing evidence quality, Carla argued for Evidence F and David for Evidence C. David and Carla battled over which evidence was best in extended and heated fifteen turn exchange. Carla said "I don't like it. F. F!" and David yelled back "C!" Of the remaining group members, Billy largely did not contribute to the group and his views were not solicited. Amy mostly made moves to regulate the task, such as checking what steps the group would take, but was largely ignored. Amy used disciplinary regulation to intervene during Carla and David's arguments, but she was ignored every time. Thus, Group 2's directive other-regulation was low quality, given limited elaboration and the highly critical nature of the monitoring, as well as limited opportunities for all group members to contribute.

Group 3's other-regulation can be characterized as dominant, although the participation was less skewed than observed for Group 2. Because Dylan and Carol have

similar total counts for other-regulation, a qualitative analysis was conducted to investigate whether Group 3 had one or two other-regulators. While Dylan regulated at a similar frequency to Carol, it was Carol who used regulation to ensure that her response was incorporated in the final product and that was not ignored. Characteristic of Carol's other-regulation, she engaged in some high quality content and task regulation, with her regulation including rationales as feedback. However, these instances of high quality regulation often involved a single partner with whom she chose to engage. For example, while arguing with Dylan about how to interpret the evidence during Task 1 (i.e., content and disciplinary regulation), Carol did not make efforts to include Bridget or Adam using group process regulation. Also, Adam's many attempts to regulate were ignored despite the high quality of his regulation during Task 1. For example, Adam provided disciplinary monitoring by indicating that the group was relying on inference, rather than focusing on the evidence. Overall, Group 3's pattern suggested that Carol dominated the group's regulation in ways that involved ignoring group members' regulatory contributions.

In summary, our results point to three forms of other-regulation which can be differentiated in nature and quality. For Group 1, facilitating other-regulation involved inclusion of everyone's contributions through the regulation of group process, behavior, and task in ways that afforded co-construction of knowledge and coordinated work on the shared product. In contrast, the other-regulation in Group 2 and 3 can be characterized as dominant. Group 2 exhibited directive regulation leading to reduced access to participation opportunities and informational feedback, with regulation that could be characterized as harsh (i.e., battling, ignoring). Group 3's other-regulation involved a

dominant group member working to control the group's final product. While at times her content and task regulation provided feedback, she simultaneously failed to be inclusive of other group member's contributions.

Competence Positioning

In this section we explore whether differences in other-regulation co-occurred with attempts to negotiate competence. More specifically, given Darnon and colleagues' (2006) findings that conflict can promote a focus on relative competence both dominant forms of other-regulation may lead group members to experience threats to their competence. In response, students may resort to promoting their competence via self-presentation or self-advocating, and in some cases, by putting down teammates. In light of a focus on relative competence, the dominant other-regulator may also demonstrate competence through these means.

We turn now to an analysis of competence positioning in these groups. Competence positioning differed between groups in its frequency and function (Table 3). While Group 1 and Group 3 had a similar tally of positioning, Group 2 engaged in three times as many competence positioning moves relative to the other groups. Further qualitative analysis suggested that this was representative of high salience of relative competence in the group's interactions. We engaged in qualitative analysis to consider how negotiating competence functioned within each group. In the following sections, we first discuss how messages regarding relative ability were made salient via competence messages within the group context in ways that provided background for negotiating competence, followed by discussing individuals' efforts made to present themselves as competent within the group.

Group-level efforts to negotiate competence. Group 1 can be differentiated by competence positioning moves that were positive and affirmed the competence of all group members. Four of their moves evidenced bolstering the competence of fellow group members rather than oneself (i.e., 2 other-positive, 2 other-advocate). Specifically, the facilitator, Donna, helped to ensure that everyone's views were valued during group discussion. For instance, Donna other-advocated for Bob to ensure his perspective was heard and prevent his view from being prematurely rejected. Here, Donna requested that Cindy stop interrupting Bob because the group would not know his contribution unless he had the opportunity to voice it. Also, on two separate occasions Bob and Donna acknowledged each other's correct contributions (i.e., other-positive) after having voiced opposing views. For example, Donna chuckled while voicing agreement with Bob's statement that their prior argument justified to the conclusion that his claim was plausible. Next, Allison offered the sole other-negative comment to Bob in jest: "No, you're wrong this time. You said 3." Despite the underlying poke at Bob's competence, this comment can be interpreted in the context of friendly competition as was indicated by Allison's follow-up statement to Donna recognizing the validity of Bob's contribution: "Look, him 1 [point], us 1. We're tied." Bob followed this exchange with an other-positive comment, "Because even though you guys are right it doesn't relate to the model, it's still good evidence." In sum, Donna's other-regulation ensured that everyone's views were treated as competent and valued. This seemed to foster positive valuing of ideas, complimenting contributions, and even other-advocating for the inclusion and respect of the minority perspective within the group.

The two groups with dominant other-regulators evidenced negotiation that involved dismissiveness and criticism of group members' contributions in ways that devalued their positions of competence within the group. Group 2's positioning involved a focus on mistakes paired with mostly explicit relative competence messages. There were 25 instances of other-negative comments; some of the most striking included Carla singling out David with salient references to relative competence in his class standing saying "You're the only one in this class who likes C" and repeating "Don't ever grow up to be a scientist." Even when engaged in a hypermedia task that included a team game, Carla and David repeatedly pointed out each other's errors. For example, Carla asked "How are you in honors literacy?" when David was slow to read from the screen. David repeatedly pointed out to the group that Carla was to blame for the computer's malfunction (e.g. "You broke it! You broke it!"; "Carla broke the computer!"). These criticisms are representative of Carla and David's interactions with each other: the two regularly putdown and criticized one another's competence, with some criticisms extending beyond the immediate group context to each other's more global competence (e.g. literacy, use of technology, career choices). Use of negative competence messages allowed David and Carla to restrict access to opportunities for others to be competent contributors. Notably, the highly salient relative ability comments escalated among other group members. Amy made two group-negative statements that served to compare their group with the other groups (e.g. "Hurry up, I think we're the only group still doing this"; group-negative). The salience of competence produced putdowns of groupmates and even between-group social comparison. In sum, Group 2 stood out as being a highly competitive context rife with competence threats: there were high stakes for perceived

incompetence as group members were very publicly and harshly recognized for incorrectness in ways that diminished their contributions' value in the group.

Group 3's dominating other-regulation was similarly linked to putdowns and restricted access to contribution opportunities, but less frequently than observed for Group 2. Further, Carol used implicit rather than explicit messages to convey competence. Carol both ignored and dismissed group members' ideas. She tended to ignore group members with whom she was not directly working; both her partner Bridget and Adam were ignored when Carol was busy trying to delegitimize Dylan's argument. Relative to the group context, Carol also criticized group members' views that did not agree with or validate her own (i.e., other-negative). Several positioning moves were made in reaction to Carol's efforts at thwarting their competence. Often, Dylan responded to Carol with other-negative comments that saliently focused on her ability. Dylan stated "You're stupid! You're so stupid!" It is critical to also highlight that the group responded counterproductively to Adam's attempts recognizing each group member's valuable contributions through other-positive competence positioning. In particular, when Adam recognized both Dylan and Carol's views as having merit, Carol simply resorted to self-presenting her own ideas (i.e. repeating "I think I'm right, guys", while ignoring Adam's positive feedback). In summary, competence positioning was indicative of both frustration with Carol's dominating, gatekeeping style of other-regulation as well as with Carol's devaluing of others' contributions. Group 3 had an overarching negative tone with attempts to broaden access to the competent contributor role; unlike Group 2, the other-regulator's competence messages were subtle via ignoring and exclusion. However, her less direct criticism still provoked significant resistance and repositioning efforts that

included explicit and salient references to ability, and evidenced the group's frustration to their limited access to making competent contributions.

Overall, competence messages were present in all groups, but messages varied in salience as well as focus. Competence positioning dominated the interactions in Group 2. Also, the competence messages served more exclusionary functions in Groups 2 and 3, whereas Group 1's messages facilitated the integration of all members' perspectives. Group 2's competence messages made individual competence evaluation salient because of the constant invocation of a competence hierarchy in service of David and Carla's own attempts to use each other's presumed incompetence to justify exclusion from contributing to the group. Finally, negotiation of competence in Group 3 was driven by Dylan and Adam's attempts to access the competent contributor role in the face of Carol's condescending approach to their contributions. Groups 2 and 3 both show that dominant and directive other-regulation seem to yield competence threats that promote harmful group interactions

Individual level: Positioning oneself as competent. We identified self-advocating as the most frequent form of competence positioning for all groups, with students repeating their own positions seemingly to ensure they were heard and their points might be taken up by the group (Barron, 2000). Barron (2000) found that repetitions in a less academically successful group were efforts to be heard and were exclusively self-referential, with much time spent pushing for one's own view. A more successful group had more varied uses of repetitions, one of which was repeating a view while discussing whether it was right. Consistent with Barron's findings, the function of self-advocating varied across groups. Members of Group 1 self-advocated to clarify

claims misunderstood by groupmates. For example, Bob said "I want to argue that it could be a two and not a three [quality rating of the evidence]" to reintroduce a comment which had been interrupted. Later, he re-advocated his contribution: "I never said it was a 2" to highlight the group's misunderstanding of his claim. Group 1 can also be differentiated by their responsiveness to self-advocating. For instance, Group 1 actively listened to Bob's repeated claims, and made efforts to both interpret and provide feedback to his ideas. Finally, it is notable that no self-positive or self-negative statements were observed, suggesting a de-emphasized focus on proving one's individual competence to groupmates.

In Group 2, self-advocating involved repeating claims without additional elaboration or justification. For example, Carla and David continued repeating their claims across 10 turns, with Carla advocating that Explanation F was highest in quality (e.g., "I don't like it. F. F!"), followed by David repeating that he preferred Evidence C ("It's C!"). Carla gave some elaboration for why she preferred Evidence F, but even when some rationale was provided, repeated claims received minimal group responsiveness (e.g. David: "No it does NOT!"). Group 2 also had 8 instances of self-positive. Self-presentation comments involved demonstrating superiority of one's competence (e.g. "Ha, I told you"; "I bet you it's better"). Also, Group 2's individual positioning was used to thwart opposing and competing views that may have threatened one's own competent contribution. Moreover, self-presentation set a competitive tone to the group's interactions that made relative ability salient.

In Group 3, Dylan self-advocated similarly to Bob from Group 1 by clarifying his claims in attempts to have his ideas included in the group task. Similarly, Adam self-

advocated 6 times, with attempts to clarify his positions (e.g. adding emphasis in saying, "It says he *received* a 10 dollar bill before closing" and "I'm talking about Sam!") and once self-advocated for task regulation (e.g. "We have to discuss the problems"). However, Carol did not work to understand or integrate their points, as we had observed for Group 1. Instead, Carol ignored each of Adam's attempts and questioned the legitimacy of Dylan's claims. For instance, she diminished Dylan's contribution saying, "I don't think that matters, but…" Additionally, in her own attempts to self-advocate, Carol directly attacked Dylan's claims, while boosting her own by saying, "Okay, so…if he paid 15 dollars…Hello?! Are you listening? If he paid him 15 dollars, there's no such thing as a 15 dollar bill." There were also 5 instances of self-positive, with four instances of Carol saying she was right and one instance of Dylan saying his own reasoning was correct in the middle of an explanation. Taken together, Dylan and Adam's individual positioning seemed to function as a means to contest a dominant other-regulator's monopolization of task access. Carol coupled self-advocating with self-presentation in ways that seemed to aim at maintaining her position as most competent contributor. While the self-presentation was not as harsh or as direct as demonstrated in Group 2, Carol's advocacy for being right and for her own ideas communicated more subtly who was competent in the group.

Discussion

Overall, our results indicate that other-regulation can take varying forms ranging from facilitative to more dominant forms of social regulation. In our results, we further distinguished sub-types of dominant other-regulation, with some leaders negotiating a more directive form of control (also see Rogat & Linnenbrink-Garcia, 2011). This finding

extends previous research which has primarily characterized other-regulation as supportive of understanding (Hadwin & Oshige, 2011; Li, et al., 2007; Vauras, et al., 2003). This distinction in other-regulation highlights qualitative differences in employed social regulation. First, in terms of the nature of the regulation, facilitative regulators focused on facilitating group process, content understanding, and task contributions, while dominant other-regulators focused on controlling and managing the task product as well as who ultimately made contributions to the work. Second, other-regulation translated into varying quality. Facilitators more often engaged in high quality regulation, given their emphasis on ensuring equitable participation and encouraging shared understanding. Dominant other-regulation was lower quality, given a focus on excluding participation and controlling the ideas integrated in the final product. The harsh and critical tone and the limited elaboration used by directive other-regulators diminished the quality of support relative to other dominant forms.

This observed variation in other-regulation has implications for group process. In an extension of work that considered directive regulation's detrimental influence on group's socioemotional interactions (Rogat & Linnenbrink-Garcia, 2011), we observed negative impact on another group process, competence positioning. Other regulators played a central role in defining competence for the group and thereby shaped negotiation, as group members engaged in competence negotiation in response to the tone set by other-regulation. Facilitators' solicitation of others' perspectives, advocacy for others, and treatment of everyone's views as valuable for the overall solution helped focus the group on achieving shared understanding and democratized access to the role of competent contributor. This encouraged all group members to take up opportunities to

contribute by making claims as well as raising questions. In this context, group members self-advocated in a productive way resembling academically successful groups in past research (Barron, 2000). In contrast, dominant other regulators monopolized access to the competent contributor role through implicit and explicit competence messages that invoked a hierarchy of competence (Altermatt, et al., 2002). Further, dominating other-regulators ignored or dismissed views, treating conflicting points as in competition with their own. These competence moves led to discussions of competence by groupmates, as well as to hostility and putdowns in reaction to dominant other-regulation. Here, it is critical to highlight that while the two dominant other-regulators varied in emphasizing explicit (Group 2) and more implicit competence messages (i.e., Group 3's dismissive talk, ignoring), both types seemed to have detrimental effects. Competence norms negotiated in the group had implications for how individuals positioned themselves to contribute on the group task.

What explains the emergence of dominant other-regulation and the accompanying low quality regulation? It is important to highlight that these groups were observed during initial weeks of an intervention focused on collaborative reasoning. During early weeks, individual students may have still operated under a conceptualization of academic tasks as individual work and student's motivational orientations may have been focused on competition and demonstrating ability, marked by a performance goal orientation. This has several implications including that (1) groups may have still been in the process of resolving the many motivational and emotional regulation challenges required when coordinating joint work (Järvelä & Järvenoja, 2011; Rogat, Linnenbrink-Garcia & DiDonato, in press); and (2) groups may have been negotiating identities in two different

figured worlds: one in which teachers evaluate students individually and a second where groups collaborate to achieve shared solutions and are accountable to peers (Jurow, 2005; Nolen, et al., 2012). As our findings demonstrated, a goal of besting others within the group and maintaining one's position of competence can be antithetical to the goals of collaboration (Levy, Kaplan, & Patrick, 2004; Rogat, et al., in press).

In terms of practical implications, our results indicate that social regulatory processes and group processes are mutually sustaining in that it is the interplay among high quality facilitative other-regulation and support for everyone making competent task contributions that promotes student learning during small group activities. This suggests that it is critical to address high quality group interactions as well as regulatory processes comprehensively to support collaboration. Taken together, these findings indicate that systems of competence are also negotiated at the group level (Gresalfi et al, 2009). Future research should investigate how leadership is initially negotiated within the group. In addition, we need to consider the role of individual differences, such as motivational orientation and student's perceptions of group work in explaining the emergence of other-regulation. Moreover, more attention should be given to the development and change in other-regulation over time, and what contextual factors and individual differences explain group members who continue to persist in providing high quality monitoring and in negotiating competence in the face of harsh feedback and sustained efforts to exclude contributions.

References

Altermatt, E. R., Pomerantz, E. M., Ruble, D. N., Frey, K. S., & Greulich, F. K. (2002). Predicting changes in children's self-perceptions of academic competence: A naturalistic examination of evaluative discourse among classmates. *Developmental Psychology, 38,* 903-917.

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84*, 261-271.

Barron, B. (2000). Achieving coordination in collaborative problem-solving groups. *Journal of the Learning Sciences, 9*, 403-436.

Darnon, C., Muller, D., Schrager, S. M., Pannuzzo, N., & Butera, F. (2006). Mastery and performance goals predict epistemic and relational conflict regulation. *Journal of Educational Psychology, 98,* 766–776.

Gresalfi, M.S. (2009). Taking up opportunities to learn: Constructing dispositions in mathematics classrooms. *Journal of the Learning Sciences, 18,* 327-369.

Hadwin, A., & Oshige, M. (2011). Self-regulation, coregulation, and socially shared regulation: Exploring perspectives of social in self-regulated learning theory. *Teachers College Record*, *113*, 240–264.

Hogan, K., Nastasi, B., & Pressley, M. (1999). Discourse patterns and collaborative scientific reasoning in peer and teacher-guided discussions. *Cognition and Instruction*, *17*, 379-432.

Järvelä, S. & Järvenoja, H. (2011). Socially constructed self-regulated learning and motivation regulation in collaborative learning groups. *Teachers College Record*, *113*, 350–374.

Jurow, A. S. (2005). Shifting engagements in figured worlds: Middle school mathematics students' participation in an architectural design project. *Journal of the Learning Sciences, 14*, 35-67.

Kempler, T.M. & Linnenbrink, E.A. (2004, April). *Re-examining the influence of competition structures in group contexts: Implications for social and cognitive interactions in small groups.* Paper presented at the Annual Convention of the American Educational Research Association, San Diego.

Levy, I., Kaplan, A., & Patrick, H. (2004). Early adolescents' achievement goals, social status, and attitudes towards cooperation with peers. *Social Psychology of Education, 7*, 127-159.

Li, Y., Anderson, R. C., Nguyen-Jahiel, K., Dong, T., Archodidou, A., Kim, I.H., Kuo, L.J, Clark, A.M., Wu, X., Jadallah, M., & Miller, B. (2007). Emergent leadership

in children's discussion groups. *Cognition and Instruction, 25*, 75-111.

Nolen, S.B., Tierney, G., Becherer, K., Cooper, S., Eng, S., & Ward, C.J. (2012, April). *Engagement in what? Negotiation of joint enterprise in project-based learning.* Paper presented at the annual meeting of American Educational Research Association, Vancouver, BC.

Rogat, T. K. & Linnenbrink-Garcia, L. (2011). Socially shared regulation in collaborative groups: An analysis of the interplay between quality of social regulation and group processes. *Cognition and Instruction, 29*, 375-415.

Rogat, T.K., Linnenbrink-Garcia, L. & DiDonato, N. (in press). Motivation in collaborative groups. In Hmelo-Silver, C., Chinn, C., Chan, C. & O'Donnell, A. (Eds.), *International Handbook of Collaborative Learning.* Taylor & Francis, Inc.

Salonen, P., Vauras, M., & Efklides, A. (2005). Social interaction—What can it tell us about metacognition and coregulation in learning? *European Psychologist, 10,* 199–208.

Strijbos, J. W., Kirschner, P. A., & Martens, R. L. (Eds.). (2004). What we know about CSCL: And implementing it in higher education. Boston, MA: Kluwer.

Vauras, M., Iiskala, T., Kajamies, A., Kinnunen, R., & Lehtinen, E. (2003). Shared-regulation and motivation of collaborating peers: A case analysis. *Psychologia*, 46, 19-37.

Volet, S., Vauras, M., & Salonen, P. (2009). Self- and social regulation in learning contexts: An integrative perspective. *Educational Psychologist, 44*, 215–226.

TABLE 1

Descriptions of Codes

Codes	Description
Regulation Types	
Content	Regulatory moves focus on the group's understanding or use of content
Disciplinary	Focus on ensuring group's adherence to norms of disciplinary practice
Task	Regulation specific to task components, directions, procedure, and enacting task
Group Process	Focus on coordinating group interactions and turn order
Behavioral	Specific to re-engaging off-task group members and sustaining on-task behavior
Competence Positioning	
Self-negative	Self-deprecating comments that aren't inclusive of group (e.g. "I'm so stupid")
Other-positive	Positive comments regarding a group member's capabilities (e.g. "That's a great idea")
Other-negative	Negative deprecating comments targeting a group member (e.g. "You're wrong")
Group-positive	Positive statements about the group's competence (e.g. "We're good at this")
Group-negative	Negative statements about the group's capabilities (e.g. "We are behind")
Self-advocate	Pushing for one's own perspective to be heard by the group when one has been ignored or dismissed (e.g. repeating claims, re-asserting claims not previously taken up)
Other-advocate	Promoting contributions of a groupmate in need of an advocate (e.g. intervening when someone is excluded or ignored, asking to return to a previously dismissed idea)

TABLE 2

Percentage and tally of different regulation types by individual within group, and percentage of total turns

		Content		Disciplinary		Task		Group Process		Behavioral		Total Regulation		Participation - % of total turns
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	%
1	Allison	1	9	8	36	5	22	20	42	2	14	36	31	28.3
	Bob	2	18	1	5	1	4	9	19	2	14	15	13	24
	Cindy	4	36	3	14	3	13	7	15	0	0	17	14	20.5
	Donna	4	36	10	45	14	61	12	25	10	71	50	42	27.1
	Totals	**11**	--	**22**	--	**23**	--	**48**	--	**14**	--	**118**	--	
2	Amy	4	18	2	29	22	46	4	31	3	38	35	36	27.9
	Billy	0	0	0	0	1	2	1	8	0	0	2	2	1.9
	Carla	9	41	2	29	12	25	5	39	5	63	33	34	42.3
	David	9	41	3	43	13	27	3	23	0	0	28	29	27.9
	Totals	**22**	--	**7**	--	**48**	--	**13**	--	**8**	--	**98**	--	
3	Adam	8	24	2	100	4	29	0	0	0	0	14	25	23
	Bridget	0	0	0	0	1	7	0	0	0	0	1	2	13.1
	Carol	11	33	0	0	7	50	2	29	0	0	20	35	41.8
	Dylan	15	44	0	0	2	14	5	71	0	0	22	39	22.1
	Totals	**34**	--	**2**	--	**14**	--	**7**	--	**0**	--	**57**	--	

Note: This table presents the frequencies and percentages of social regulation types that occurred during the three groups' discussions. Percentages assist group comparisons since observation length and on-task engagement varied between groups. In addition, other-regulators for each group are designated using bold font. Finally, total number of turns for each group was - Group 1: 258 turns; Group 2: 215 turns; Group 3:122 turns.

TABLE 3

Frequency of Competence Positioning Moves by Group

Competence Positioning Moves	Group 1	Group 2	Group 3
Self-positive	0	8	5
Self-negative	0	1	0
Other-positive	2	0	1
Other-negative	1	25	0
Group-positive	0	0	0
Group-negative	0	2	8
Self-advocate	18	40	13
Other-advocate	2	1	0
Totals	**23**	**77**	**27**

Chapter 3: Studies 2A & 2B - Middle Schoolers' Negotiation of Marginality in Inquiry Science Collaboration: Relating Students' Acts of Agency to Trajectories of Participation

The literature on collaborative group work and reform-oriented curricula highlights the importance of social aspects of collaboration for students' successful group work. For example, there is an emphasis on the need for mutuality (e.g., Barron, 2000) and social regulation (e.g., Rogat & Linnenbrink-Garcia, 2011; Rogat & Adams-Wiggins, 2014), the pitfalls of status hierarchies (e.g., Cohen & Lotan, 1997), and the role of authority (e.g., Engle et al., 2014). A key challenge for students in collaboration is achieving functionality as a cohesive group rather than operating as merely an aggregate of individuals who are connected by proximity alone. Part of this challenge resides in students' difficulties establishing a socioemotionally and motivationally supportive environment (e.g. Rogat & Adams-Wiggins, in press). For researchers and practitioners concerned with equity in education, the social and emotional side of collaborative learning is highly relevant, as a great deal of evidence has accumulated demonstrating the role of social interactions in creating equitable or inequitable learning opportunities for students (Esmonde, 2009; Kurth et al., 2002; Langer-Osuna, 2011; Leander, 2004; Wortham, 2004). Further, other research has implicated discourse and social interactions as spaces in which sources of motivation, such as a sense of competence, can be shaped (Adams-Wiggins & Rogat, 2013; Altermatt et al., 2002; Darnon et al., 2006; Gresalfi et al., 2009; Rogat & Adams-Wiggins, 2015).

The extant research suggests that we will benefit from attending to the increasingly ubiquitous collaborative group activities found in schools: students'

interactions during groupwork likely will offer important insights into the intersection of academic achievement, motivation, and social-emotional development. While status problems in groupwork and the role of equity have been focal points in research on students' participation in groupwork over time, we know little about socially isolated students' actions when they are on the fringes of group activity. In a groupwork context, social isolation is likely to have implications for student motivation and engagement as well as students' self-perceptions. Yet, as Gresalfi and colleagues (2009) noted, even in the most restrictive contexts people can exercise agency, although the means of exercising agency and consequences vary (p. 53). As such, an important step to understanding how we can better foster socioemotionally and motivationally supportive environments for students in collaboration is to address the question of agency, or the ability to enact one's own desired goals in a social context; in this case, the context is collaborative groupwork.

Therefore, this study aims to develop a social interaction driven framework for understanding students' agency in groupwork and to examine the outcomes of students' acts of agency over the course of a semester. Through the examination of students' agency in inquiry science collaboration, this study will bring us closer to understanding the ways that small group interactions come to bear on individual students' participation and inclusion in the classroom over time. The context for the present study has special relevance: the inquiry science context involved a great deal of collaborative learning opportunities. As demonstrated in Study 1, negotiation of competence as part of identity in early adolescence is afforded by curricula in which students have increased authority and learn through collaboration.

Marginality as a Framework for Social Isolation in Collaborative Learning Contexts

In order to understand socially isolated students' agency in inquiry science collaboration, an appropriate lens for understanding the isolation itself must be adopted. The terms "exclusion" and "excluded" themselves may be responsible for the aforementioned dearth of research focused squarely on socially isolated students' agency in collaborative learning contexts: when used to describe a person's undesired state of non-participation, "exclusion" implies an action taken by only one party because it focuses on the individual(s) doing the excluding with less attention to what is being done by the socially isolated person. For example, Kurth and colleagues (2004) focused on how a student named Carla who came to be excluded, but focused primarily on what others were doing *to* her. Is the socially isolated person withdrawing from activity, resigned to an isolated position? Is the student actually satisfied with a less central role? Or does the student pursue greater inclusion and greater centrality to group activity, even in a subtle way? When a student is experiencing an obstruction to achieving one's own goals, the student is likely to push back against the perceived source of obstruction. Discussing low-status group members' agency requires a conceptualization of the process as negotiated if we are to understand students' responses to obstructions to enacting their goals. More important, students' attempts to push back can highlight a number of features of collaboration: aspects of group activity that obstruct students' enactment of goals, aspects of group activity that may unintentionally create systematic inequities in the learning environment, and aspects of group activity that are unsupportive to students motivationally.

The literature on marginality is helpful in understanding how social exclusion is a socially constructed, or negotiated. *Marginality* here describes any situation in which a student becomes socially isolated. While some researchers in social psychology have defined marginality as deviation from the prototypical member of one's group (e.g. Ellemers & Jetten, 2013), the focus here is not on social isolation in the form of difference from one's peers, but instead on social isolation in the form of differential outcomes or differential access to valued resources due to an undervalued position within one's group. The present definition follows from definitions of low status in the status hierarchies literature (Cohen & Lotan, 1997). Marginality is an inherently relational or positional construct, as it implies that other students are somehow central in the social context (Holland et al., 1998; Langer-Osuna, 2011). A marginal student experiences barriers to participating fully within a collaborative group. For example, the student may lack physical access to the task materials and therefore be unable to fully participate or the student may be ignored by groupmates when the student makes a contribution; both situations would constitute an episode of marginality in the present terminology. The most severe and prolonged forms of marginality entail what is often referred to as *marginalization*, which involves pervasive social exclusion and reduced access to valued resources in society more broadly because of membership in a devalued or "Othered" social category (hooks, 1990). Research on status problems in groupwork and exclusion in the classroom primarily has focused on marginalized social groups (e.g. Cohen, 1994; Bianchini, 1999; Nasir & Hand, 2008; Rubin, 2007; Carlone et al., 2014). In a study that deviates from this pattern, Davies and Hunt (1994) captured how binary logic creates competent and incompetent students in "teaching-as-usual".

Marginalization is critically important to understand, yet without a conception of marginality that inherently presumes fluidity and flexibility in individuals' positions, we are unable to fully understand and explain situations in which individual members of groups that are marginalized are able to access resources that most members of their group cannot access; likewise, we are unable to understand the ways that justifications for marginalization can become a "moving target" which is continually modified to sustain the very core conditions that enabled marginalization and inequity to emerge in the first place. In order for the construct to capture both short- and long-term social isolation, the marginality construct here is defined to afford fluidity despite the possibility that marginality in practice is very stable. Thus, a student who only momentarily cannot access task tools has experienced a brief episode of marginality, while a student who is subjected to microaggressions during group work or bullying also has experienced marginality in a more severe and prolonged form, known as marginalization (Sue, 2010).

Studying Agency in an Inquiry Science Collaboration Context

The present study focuses on marginal group members' ways of enacting agency from their less-central positions within their groups. Nonetheless, most currently existing conceptions of agency in the science classroom privilege the student's relationship with content over the student's relationship with other students or even with the teacher. For example, Basu and colleagues (2008) describe "critical science agency" as students' engagement with content knowledge and education for social change. Similarly, the framing of student agency in math classrooms has led to constructs such as "conceptual agency" and "disciplinary agency" (Cobb et al., 2009; Gonzalez & DeJarnette, 2012). Cornelius and Herrenkohl's (2004) discussion of classroom participation structures

addressed students' relationships with each other in a reform-oriented science classroom. By attending to the role of discourse in a reform-oriented science context, Cornelius and Herrenkohl were able to document how students' gain ownership over ideas and the ways student ownership shaped student discourse.

Cornelius and Herrenkohl's findings have particular relevance here: while their paper generally highlighted high-quality interactions between students, findings by Rogat and Adams-Wiggins (2014) as well as Barron (2000) demonstrate that not all students experience centrality or ownership when they are part of a collaborative group. The salient episodes of exclusion with directive other-regulators observed by Rogat and Adams-Wiggins suggest that students most likely experience marginality in inquiry science contexts, despite the deliberate shift of power into the hands of students. More specifically, the marginality may not be something that just casually or accidentally emerges, but is instead forwarded by students' own groupmates who aim to control the group's products (Rogat & Adams-Wiggins, 2014, in press). Further, Rogat and Adams-Wiggins' research occurred within a middle school context, which may partially explain the frequent use of competence-centered putdowns and negative socioemotional interactions to exert influence within groups (Adams-Wiggins & Rogat, 2013; Rogat & Adams-Wiggins, in press). Thus, there is much reason to suspect that agency enacted during inquiry science collaboration will not be solely about students' relationships with the content, but instead about their relationships with each other.

Present Study

The present study aims to create a framework with a focus on interpersonal relationships and messages about relative competence for understanding students' agency

within middle school inquiry science collaboration. By focusing on this side of agency in inquiry science, we step closer toward an understanding of middle school students' motivations in groupwork; we also employ a lens that gives greater attention to domains of the adolescent experience that may be of greater importance to the students themselves (i.e. peer relationships and competence). Here, the framing of agency deliberately decenters forms of agency that focus on relationships with content and discipline-linked identities (e.g. Barton & Tan, 2010; Basu et al., 2008; Cobb, Gresalfi, & Hodge, 2009; Jackson & Seiler, 2013). Specifically, this decentering allows non-participation to be captured as a negotiated, goal-oriented process in line with Hickey's (2003) discussion of marginal non-participation.

To recast agency as both negotiated and having important ramifications beyond a practice-linked or disciplinary identity, the emphasis here is instead placed on marginal positional identities and the ways that students in a given sociocultural context strategically use resources, or tools, in the environment to take action regarding their own marginality. These tools can be social or cultural resources like people, objects, and cultural norms, or intrapersonal resources such as students' own disciplinary and conceptual agencies (e.g. knowledge of discipline-linked jargon and ways of speaking). Thus, acts of agency here include any act a marginal group member takes in response to becoming marginal.

Further, the present study occurs within the context of the Promoting Reasoning and Conceptual Change in Science curriculum; this curriculum involves a great deal of pairwork and groupwork, as well as argumentation. These features are expected to offer unique opportunities for students to use group talk as a space for constructing a social

identity among their groupmates. In addition to the question of *how* middle schoolers enact agency in inquiry science, it is also of interest to examine how the forms of agency students enacted relate to students reduced or continuing marginality.

Therefore, this is a two-part study: in Study 2A a framework for acts of agency will be elaborated and in Study 2B students' trajectories of marginality will be analyzed in relation to their acts of agency exercised over a semester. Study 2B will employ the framework developed in Study 2A to assess changes in marginality over a semester for individual students. The following research questions were addressed:

1. How do marginal group members exercise agency in a collaborative inquiry science context? (Study 2A, focus on acts by individuals within a group)

2. What is the relationship between the forms of agency exercised by marginal group members and their trajectories of marginality over the course of a semester? (Study 2B, focus on marginal individuals within groups)

The two parts of the present study contribute to our understanding of how middle schoolers exercise agency in interpersonal interactions with peers and also clarify the effectiveness of middle schoolers' responses to marginality. A framework for middle schoolers' agency in their interactions with classmates extends previous research on status problems and offers insight into how low-status identities are constructed in the classroom.

Method

Participants & Curricular Context

Participants in the present study were selected from the classrooms of four seventh-grade science teachers in an ethnically-diverse, suburban middle school in the mid-Atlantic United States; all of these classrooms were participating in a series of inquiry science units over the course of a semester. This set of studies included only participants who were members of any of the 16 videotaped groups from the 8 videotaped class periods in the larger sample (N= 441). The inquiry science units are designed to encourage scientific reasoning and engage students in scientific practices such as evaluating evidence and using evidence to evaluate model fit (Chinn, et al., 2008; Chinn & Buckland, 2011; Duncan, et al., 2011; Promoting Reasoning and Conceptual Change in Science, PRACCIS). The curriculum also sought to develop norms for relying on evidence and providing justification for claims.

Students established shared criteria that served as the basis for evaluating model and evidence quality. Students engaged in collaboration in groups of three or four as well as pairwork with a partner in their groups. The curriculum in this study provides a rich context for understanding agency in the classroom: features of the curriculum support a shift of authority to students, thus offering increased opportunities for students to engage in discussion and student-student interactions. Yet, previous findings suggest students may engage in practices that lead to reduced participation by groupmates (Adams-Wiggins & Rogat, 2013; Cornelius & Herrenkohl, 2004; Rogat & Adams-Wiggins, in

press; Rogat, Witham, & Chinn, 2014). Thus, student interactions are the focus of the studies.

Selection of Groups & Observations

Participants in this study were a subsample of students in the larger study. In the larger study, sixteen groups of students were videotaped during groupwork. Groups were selected through a two-stage process. In the first stage, only groups from which at least two students had been interviewed were retained. Interviewed students almost exclusively were members of videotaped groups (see interview protocol in Appendix C). Teachers were asked to provide two students from each of their videotaped groups to be interviewed at the end of the semester; in some cases, students did not consent to participation and teachers sought additional students from videotaped groups to replace them. Further, only groups with relatively stable composition across units were included: groups in which more than one student was removed from the group were excluded. As two teachers reconfigured their videotaped groups every unit, their class periods' groups were ultimately excluded from the study.

In the second stage, interviews for students in the remaining groups were screened for indicators of marginality. The use of interviews for screening meant that groups in which no interviewed member reported the presence of an indicator in his or her group would be excluded from the sample. The final sample included five groups who met all criteria out of the original sixteen groups. After selecting groups, groups' observations were selected from all videotaped groupwork periods. The aim of selection was to include 4 observations and achieve balanced observation time across groups. Criteria used to narrow the pool of observations for the sample included the following: all group

members were on-camera for the observation and audio quality was viable for

transcription and coding purposes. In light of the goals of selection, this led to some

groups (i.e. Group C and Group F) having fewer or greater than four observations

included in the sample in order to ensure similar lengths of observation time.

Identifying Marginal Group Members

Marginality is here defined using a sociocultural lens: marginality is a dynamic

and negotiated positional identity emerging out of social interaction and as having the

potential to be short- or long-term in light of opportunities to exercise agency (Penuel &

Wertsch, 1995). Marginality was identified using a set of indicators developed studying

a single group from the current sample (Adams-Wiggins, 2014; see Table 4). The

indicators were created through qualitatively coding and analyzing two sources:

interviews and a sample of videotaped observations for a single group. First interviews

for each of the four group members were coded to identify indicators of marginality and

subsequently two videotaped observations were coded for the group. Finally,

discrepancies between analysis of interviews and analysis of videotaped observations

were reconciled to identify broader patterns and create a final set of marginality

indicators. Marginality indicators included: deference, evidence of low academic

performance, failure to address group member(s), pushed out of group talk, and target of

ridicule. For each student of a group in a given observation, a rating was assigned

ranging from zero (marginality absent) to six (severe marginality) (see rating system in

Table 5). In light of the indicators used to assign marginality ratings for each individual

observation, the ratings are best understood as representing a given student's level of

inclusion and ability to participate at the nominal level during a given observation (i.e.

being able to interact with the group and be treated as a valued member during a single observation). Thus, interpretative analyses accompanied the use of marginality ratings in order to capture how each observation fit within a given student's marginal identity trajectory across the semester since marginality ratings alone were unable to address the marginality across longer periods of time.

Study 2A: A Framework for Agency in Inquiry Science Collaboration

Study 2A addresses the following question: how do marginal group members exercise agency in a collaborative inquiry science context? Marginal group members' agency was addressed using qualitative methods to analyze the various acts they use to attempt to impact the group interactions and group products. To prepare for Study 2A, each videotaped observation and each interview transcript was qualitatively coded for marginality indicators (See Table 4). Marginality indicators observed in a single observation were applied in determining a marginality rating for a given student during the observation (See Table 5), while marginality indicators from interviews informed interpretation of group activity.

Coding acts of agency. Acts of agency were coded for each observation anytime a group member was identified as marginal during the observation (See Table 6). The coding scheme for acts of agency was created using the methods outlined by Angelillo, Rogoff, and Chavajay (2004) to maintain fidelity to the data. Memos were also constructed to guide and document the interpretive process. The final set of acts of agency was identified through a two-stage analytical process. First, two groups from two different years of PRACCIS curriculum enactment were examined to develop an

exhaustive list of actions taken by group members who had become marginal and overarching categories were identified. In the second stage, which is presented here in Study 2A, the full sample for the present study was analyzed using the coding categories produced during the first stage. This second stage allowed for a refinement of initially created categories and validation of the categories using a broader range of student groups. Further, for each instance of an act of agency an outcome code was assigned: acts of agency that led to groupmates' immediate engagement with the marginal group member were deemed "successful/taken up" while acts that did not immediately lead to engagement with groupmates were deemed "failed/ignored or rejected".

Data reduction. Study 2A employed observation summaries, a cross-observation summary, and individual group member summaries to reduce the data. First, for each observation and observation summary was constructed, yielding 24 summaries in total. Observation summaries included the following information: participation frequencies by group member (turn counts), marginal group members, task summary, summary of group interactions, summary of marginality episodes, frequencies by type for acts of agency by group member, outcomes for acts of agency by group member (success or failure), summary of acts of agency for each group member, and any additional notes that appeared relevant (See example in Appendix A). Next, a cross-observation summary document was created to track the following information: frequency of acts of agency by type across all observations, all contexts in which each type of act of agency was observed across all observations, exemplar instances of each type of act of agency, and conclusions about the outcome of each type of act of agency across all observations.

Study 2B: Acts of Agency and Trajectories of Marginality

The second part of the study addressed the second research question: what is the relationship between the forms of agency exercised by marginal group members and their identity trajectories over the course of a semester? The focus here was on identifying trajectories of marginality for marginal group members over the course of the semester and then identifying common features distinguishing students with trajectories moving toward centrality from those with continually marginal and increasingly marginal trajectories. The question was addressed via a combination of quantitative and qualitative methods in order to highlight the relationship of acts of agency with long-term participation and marginality. A total of four group members' trajectories were analyzed.

Data Reduction.   Summary documents and coded observations from Study 2A were the key source of data for Study 2B. The bulk of analyses were conducted using information from marginal group members' individual summary documents. For each marginal group member one *individual summary* document was created. In the individual summary documents, the following information was included: graphic representation of the student's marginality ratings across all observations, frequencies for acts of agency by type across observations, summary of combinations or sequences of acts of agency used, and an analytic summary of the function of each type of act of agency in light of the combinations/sequences of acts used by a given group member (See example summary in Appendix B).

Mapping trajectories. Using observation summaries from Study 2A, each group member was assigned a marginality rating for each observation in which the group member was present. The marginality rating system employed here can be found in Table 5. The rating system consisted of a scale ranging from zero to six, with zero

indicating an absence of marginality for the group member and six indicating severe marginality for the group member. If a group member was linked to a marginality indicator for a given observation, the group member was identified as marginal for that observation and a marginality rating ranging from one to six was assigned according to criteria in the marginality rating system.

For each student, a trajectory of marginality was constructed by creating a line graph of the student's marginality ratings across observations. Further, a qualitative analysis of the student's trajectory was conducted using the student's observation summaries and individual summary; in line with Calabrese Barton and colleagues' (2013) approach, attention was given to events that appeared to be crucial in each student's identity construction based on frequent/repeated retrospective reference to the event during interviews and during groupwork. Students' trajectories were categorized as inbound (decreasing marginality), outbound (increasing marginality), or other (stable or ambiguous). Building from Jackson and Seiler (2013) and Wenger's (1998) conceptions of inbound and outbound trajectories as representing identification with the discipline of science or a community of practice respectively, inbound and outbound here represent identification with one's group in an inquiry science classroom. Thus, a student with an inbound trajectory is one who is increasingly able to claim full membership of the group, while a student with an outbound trajectory is decreasingly able to claim full membership of the group.

Results

Study 2A: A Framework for Agency in Inquiry Science Collaboration

The aim of Study 2A was to identify and describe the acts of agency middle schoolers enact while participating in an inquiry science curriculum. A total of seven specific acts of agency were identified (See Table 6). The seven acts of agency identified in the present study can be divided into two larger categories: managing constrained participation and leveraging resources. In this section, each of the seven acts of agency observed will be defined and then examples as well as an analysis of each type of act's function during group activity will be discussed.

Defining seven acts of agency. The first larger category of acts of agency was managing constrained participation. *Managing constrained participation* as a category was distinguished by its emphasis on asserting control or competence and its focus on preserving waning access to influence rather than proactively increasing a student's centrality in the group. This category only contained one act of agency, which was also managing constrained participation. Managing constrained participation was an act of agency in which students aimed to maintain the remnants of their waning access to participation. Managing constrained participation included acts such as employing aggression or retaliating against a groupmate, escalating a disagreement or using a confrontational approach, talking over a groupmate or ignoring interruptions to one's own attempts to contribute, explaining away one's own mistakes, withdrawing from group activity, and expressing a lack of concern for the task.

The second larger category was leveraging resources. For six of the seven total acts of agency, the term "leveraging" was used to describe the acts that focused on students' use of tools to move toward centrality within their groups. Basu and colleagues'

(2008) study of critical science agency reported that a student stressed the importance of leveraging resources strategically: using resources in ways that position oneself with authority was how one student, Neil, negotiated participation and made his work relevant to a larger community. Also, Basu and colleagues (2008) emphasized the importance of leveraging resources when faced with oppression, which is relevant for students in marginal positions. Here, the language of "leveraging" reflects the framework's casting of agency as a matter of putting available resources to use in order to achieve one's own goals when other means are either unavailable or have failed, rather than focusing on an individual in separation from others or the surrounding environment (Baxter Magolda, 2000). These resources, or tools, were people, material objects, and cultural norms. This is a form of agency in line with Wertsch's (1998) approach to understanding of power through examination of the ways cultural tools reshape power and authority.

The six types of leveraging deal with various resources in the inquiry science classroom and collaborative group (See Table 6). Two types of leveraging focused on the normative patterns of verbal and nonverbal communication as tools for decreasing one's own marginality. The broadest type of leveraging, *leveraging communication and social skills*, involved a marginal group member using social or communication skills as a resource by which he or she can gain access to influence in the group. Some acts that represented leveraging of communication and social skills included positioning oneself as a help seeker or dependent upon groupmates, using a direct speaking style to explicitly state the perceived cause of one's marginality (e.g. identifying a groupmate comment as rude, stating that one does not have access to tools, stating that a misunderstanding is occurring), using an indirect speaking style to redirect group activity to increase one's

own centrality (e.g. repeating a request, elaborating on an idea, gesturing to imply a request for tools), and using compromise.   The second talk-centered act type was *leveraging humor and off-task talk*, which involved a marginal group member using humor or off-task activity to gain access to influence. This act of agency included attempts to entertain the group (e.g. making jokes or acting out briefly in a humorous fashion), participate in jokes about oneself made by others, and initiating an off-task talk episode.

Three types of leveraging focused on using cultural forms of organization as the tool for decreasing one's marginality. The first was *leveraging external authority*, which occurred when a marginal group member engaged in practices such as directing ideas and questions to the teacher, calling on the teacher as a mediator, or referencing teachers' directives or task guidelines to back one's own ideas. *Leveraging status hierarchies* involved invoking a status hierarchy in acts like forming an alliance with a more central group member, forming an alliance with one marginal group members against another marginal member, complying with the requests of a high status groupmate, rallying group members against another groupmate, referencing one's extensive knowledge on a topic, or initiating self-deprecating comments or jokes. *Leveraging norms of the discipline* was specific to inquiry science curricular contexts and involved refocusing a disagreement onto the nature of the discipline or curriculum, referencing reasons and evidence, or advocating for one's own understanding of science disciplinary norms.

Finally, *leveraging scarce task tools* involved a marginal group member using the scarcity of a tool to pressure the group into interacting with him or her through acts such as taking over control of a laptop or pulling away from a groupmate who was trying to

take over operation of the task tools. In this curricular context, the scarce task tool was typically a laptop computer, which was not present for all groupwork across the semester.

Functions of acts of agency and exemplars. In Table 7, frequencies and success rates for each of the seven acts of agency across all participants and all observations are presented. All act types with the exception of leveraging norms of the discipline were observed in this sample. Among the seven types, the most frequently used acts of agency were leveraging communication and social skills, leveraging humor and off-task talk, and managing constrained participation respectively. Leveraging scarce task tools and leveraging external authority were used infrequently relative to the other act types.

Leveraging communication and social skills. This act of agency was the broadest type of act, the most frequently occurring act, and had the broadest range of functions for marginal group members. The first function of leveraging communication and social skills was to clarify a miscommunication or point out unwanted behavior when it was becoming a basis for ridicule. In one example of this, Arjuna clarified a miscommunication to push back against Jacob and Lauren's criticism and then went into off-task talk about the teacher keeping their group's cell model:

Jacob: (pointing to camera) Why is that always on *us*? That's annoying.

Arjuna: Because.

Jacob: Why not put it over there? (pointing across the classroom)

Lauren: It's because Arjuna always has to talk.

Jacob: Why do they put them things then? (pointing to audio recorders on

table)

Arjuna: It's not *my* fault. It's because she always calls on me (referring to

teacher).

Lauren: (repeats Arjuna's comment in a mocking tone)

Jacob: You raise your hand.

Arjuna: No, even when I don't raise my hand.

Jacob: That's true. I've seen that.

Arjuna: And they put that there, too…quite a lot. (pointing at camera near

another group).

Here, Arjuna's clarification redirected the group who was blaming him for an annoyance. The second function of members leveraging communication and social skills was to squeeze into a speaking space dominated by one's groupmates. In Group C, Leesha leveraged communication and social skills to intervene once Carson's off-task talk began to dominate the speaking floor:

Matt and Carson are laughing during off-task talk.

Leesha: Which…(interrupted by Carson's continuing off-task talk)…[laughs]

which model or models does this evidence support?

Carson: Ummm, I don't know! Let's just continue.

Leesha: No, we cannot continue.

Carson: Look, it's Sally the sheep!

Leesha: What?! So which evidence is it?

Leesha gave brief attention to Carson's off-task comments and then redirected the group to focus on the task. By acknowledging Carson's disruptive comment briefly, she was able to grab the group's attention long enough to restate her question. The third and final function of leveraging communication and social skills was to re-engage the group by

positioning oneself as a help seeker. Positioning oneself as a help seeker took place during both on- and off-task talk. In Group D, Patrick positioned himself as a help seeker by asking for the meaning of a slang term. Earlier in this observation, Shane ignored Patrick's attempts to engage him in off-task discussion. At one point Patrick called Shane three times before being acknowledged, as Shane is mostly engaged with Necha. Patrick successfully engaged his groupmates' during off-task activity by asking a question that necessitated a response:

Patrick is watching Necha and Shane from across the table. His pairwork

partner, Erica, is working on her own and at times is playing with a pen. Patrick

has his hand raised, waiting for the teacher. Patrick is commenting in the off-task

discussion and Necha and Shane have been speaking directly to each other

without addressing him.

Necha: I'm gonna bite your hand.

Shane grabs Necha's arm as she gestures suggesting she will bite his hand. Shane

pushes Necha's hand back toward her mouth so she will bite her hand.

Shane: Hahaha bite your own hand. How awesome would that be?! [Shane and

Necha both laugh, Shane is gesturing with his arm outstretched to Necha] Let's

go.

Necha: [laughs] What, bite your finger?!

Shane: No, arm wrestle me.

Necha: No. [pauses] Because you would lose very…

Shane: Ah haha, you're scared.

Patrick: If you won't lose, why are you afraid?

Shane: Scurred. [speaks into table microphone] Necha's a-scurred.

Patrick: What's "scurred"?

Shane: Scared.

Patrick: Oh.

Necha knocks a pencil cup across the table into Patrick's area and he grabs the cup and puts it on his hand in an attempt to entertain Shane and Necha before the teacher arrives to respond to Patrick's raised hand.

Shane: (gesturing at the pencil cup Patrick is holding) Gimme that! Gimme that! Gimme that, booooooooy!

Patrick passes the cup to Shane.

Patrick's leveraging communication and social skills during an off-task episode enabled him to increase his interaction with Shane and Necha despite previously being overlooked. Carson and Greg of Group C leveraged communication and social skills to position themselves as help seekers during on-task episodes, as well. Carson and Greg used this act of agency to gain access to groupmates' work once they had begun withholding ideas from them. By positioning themselves as needing help in both on- and off-task contexts, Carson, Greg, and Patrick were able to leverage their communication and social skills to put pressure on groupmates to respond to them, even when groupmates had begun ignoring them. Patrick was able to join off-task talk when he had been marginal beforehand. For Carson and Greg, positioning themselves as help seekers helped them avoid being casted as non-contributors in the group and therefore provided them continued access to Luke and Leesha's intellectual contributions.

Leveraging humor and off-task talk. Leveraging humor and off-task talk was the second most prevalent act of agency observed. This act functioned to push on-task or more central group members out of group talk when the marginal group member was frequently off-task. In one example of this, Lauren leveraged humor and off-task talk to block Arjuna's ideas from being taken seriously in the group: Lauren took a sarcastic tone with Arjuna when she disagreed with his idea ("YEAH, OKAY!"). Similarly, Ty of Group F leveraged humor and off-task talk to push Paul and Jivan, who were more central than Ty, out of on-task talk by referring to a previous class period in which Jivan gave "oxygen" as an incorrect answer:

> Jivan: (interrupting Ty) So population varies.
>
> Ty: That's what I said! (with emphasis)
>
> Paul: You were talking about genes and stuff like that (laughs)
>
> Jivan: (writing) The population varies…
>
> Ty: Pauses. I said two (inaudible) (to Jivan)
>
> Paul: Yeah, yeah, two types of genes…
>
> Jivan: Yeah, that's (inaudible)
>
> Paul: We're talking about population, not genes.
>
> *Shonyce, Jivan, and Paul laugh.*
>
> Jivan: (inaudible)
>
> Ty: Oh yeah? I'm not the one who said "oxygen".

A second function of leveraging humor and off-task talk was to regain the attention of off-task group members if the marginal group member was focused on the task. For example, in Group D, Patrick had been trying to get Shane and Necha to engage him in

task-relevant discussion and then briefly joined their off-task activities to entertain the group. After entertaining the group, he launched back into posing questions about the work, saying "Okay, I have a couple things actually" to initiate on-task activity. Marginal group members also leveraged humor and off-task talk to reframe ridicule as a joke by joining in on a joke about oneself. In Group C, Luke laughed along with Carson as Carson made a joke about his incorrect use of the slides on the group's laptop:

> *Greg leans over Luke's shoulder and gets very close to his face and stares at Luke. Luke maintains doesn't make eye contact with Greg. The computer is heard starting up and the group waits.*
>
> Leesha: (sighs)
>
> Carson: Oh my gosh, could you guys make this thing go ANY slower?
>
> Luke (laughing): I just realized it's the same thing circling over and over
>
> Carson: Are you serious? You've been watching the same PowerPoint over and over? Oh my god, you gotta be kidding me, Lucas.
>
> *Leesha shakes her head, rolls her eyes, and laughs.*
>
> Greg: (laughs) Oh my god.
>
> Carson: All that work. (to someone outside the group) That kid was playing the same video like 50 times!
>
> Leesha: Why are you still playing this?
>
> Carson: Come on [Greg], let's answer this question.
>
> *Greg walks back to his side of the table.*
>
> Luke: Ohhh, it's repeat experiment!

Luke joined in on a mild joke made by Carson, resulting in his sustained communication with the remaining group members. This also enabled Carson to build on Luke's act of agency by his own leveraging of humor and off-task talk to continue communicating with Chelsea and Luke. The fourth and final way marginal group members leveraged humor and off-task talk was to gain access to the speaking floor when they unable to contribute academically-relevant content. This was a common function of leveraging humor and off-task talk in Group C for Carson. In one example of Carson's leveraging humor and off-task talk to gain the speaking floor in the absence of an academically-relevant content contribution, he interjected with nominally task-relevant comments. As Leesha operated the group's laptop, Carson took a joking tone while telling her to move more slowly. Yet, once Leesha slowed down he still was unable to contribute meaningfully to the task:

Carson: Stopppppp, you're going too quick!

Leesha: What?

Carson: Oh, I'm not reading it. I just wanted to…

Leesha: I already switched it! (laughs)

Carson: I like the white-faced sheep better because [interrupted by Leesha]

Leesha: [reading from the screen] Dolly got her nucleus from one sheep but the rest of the cell from another. What does she look like? She looks like the nucleus donor. What does it tell you about the nucleus donor?

Luke: That the nuculus depends about…what you look like?

Leesha: Whaaaat?!

Carson: The white-faced sheep is so much better.

Leveraging external authority. The first function of leveraging external authority was to get on-task central group members to relinquish the speaking floor or control of the direction of activity. When Group F's Shonyce and Jivan were discussing a worksheet the group was currently working on, Ty took advantage of the teacher's interjection to achieve centrality in group activity:

Teacher: Strongly agree, huh, [J]? *(walks away)*

Ty: Okay, so now we should discuss about this, right? So, everyone agrees on the same thing? Right? Everyone agrees on the same thing?

Jivan: Yeah, but [Shonyce] has 1. She put it as a two. *(pointing to Rania)*

Ty: We put it as a 2.

Here, Ty used the teacher's interjection as grounds for him to take a leading role and thereby influence how Shonyce's competing answer was understood. Her answer was cast as deviant rather than something to be taken up and explored further, allowing Ty to step into a central role in the group. Marginal group members also justified their own low levels of participation using this act of agency. In one example of justifying low levels of participation, Carson (Group C) leveraged external authority by referencing both the instructions for a task ("We're supposed to be doing this as a group! 'Complete with group'!") and the teacher's specific instructions ("She said group") to justify his unwillingness to work with his pairwork partner, Greg, on the task and his insistence that his Leesha and Luke worked with him instead since he relied on them for answers. Finally, leveraging external authority was used to redirect a groupmate with high academic status. An example of this occurred in Group A when Lauren said "Arjuna,

we're supposed to do this as a group" to get Arjuna to share the laptop since it was out of her line of sight.

Leveraging status hierarchies. Leveraging status hierarchies functioned in two ways. First, marginal group members leveraged status hierarchies in order to exclude a more central group member. For example, Patrick leveraged status hierarchies first against Erica and then against Necha in retaliation for the group having ignored him earlier in the observation:

Teacher speaks to the class indicating there are two minutes left to complete a worksheet.

Shane: Uh oh.

Erica: We're supposed to do *that*?

Patrick: Yeah.

Shane: But she told me not to turn the page!

Patrick: Yeah, but you're supposed to do *this*.

Necha returns to group.

Shane: What time is it? Two more minutes?

Necha: [Patrick], can I copy yours?

Patrick shakes his head "no".

Necha: [Erica], can I copy yours?

Patrick emphasized how his groupmates have should have known to complete their work and presented the situation as if it were only logical that the group should have known what to do. Patrick himself had already completed the worksheet and did not share his answers with his groupmates. Necha asked explicitly to copy his answers and he took the

opportunity to further withhold his work from the group. Patrick took advantage of his own position to cast his groupmates as slackers who did not actually deserve help; this appeared to be tied to him being ignored earlier by the group. The second function of leveraging status hierarchies was to further challenge another group member while bolstering one's own position:

> Paul: But still, both have some type of species. (Pauses, everyone writes) Okay, 12.
>
> Ty: I know. Both have a type of ummm…of the…environment was changed by humans.
>
> Paul: No, not always.
>
> Ty: They're (inaudible) by humans.
>
> Paul: No, but, humans probably didn't take…
>
> Jivan: (Interrupting) They're an invasive species.
>
> Paul: Yeah, they probably didn't take…
>
> Ty: (interrupting, looking at Paul with a sarcastic expression) Then how did they get there?
>
> Paul: They, they, they learn the backstroke (laughs)
>
> Ty: No noooo (laughs)

J and Paul had a long-standing competitive relationship in which Paul frequently assumed a minor leadership role in directing group activity by guiding the group procedurally. Ty regularly used his own high academic status to undermine Paul's attempts to direct the group. Here, Ty presented an answer before the rest of the group had time to think about the question and then mocked Paul for his reasoning when Paul questioned Ty's ideas.

Paul was able to reframe Ty's attempt to leverage status hierarchies, though, by turning the situation into a joke.

Leveraging scarce task tools. This act of agency functioned exclusively to deal with central group members who monopolized task tool usage. In one instance of leveraging scarce task tools, Ian of Group B had his suggestions to the group ignored and then rejected by Alana; he then used the single laptop in the group to exert influence over the group's next steps:

Marc: Carbon dioxide. See, they're equal in the dark. There's more oxygen when it's… [interrupted by Ian].

Ian: [interrupting Marc] In the light.

Alana: Yeah, I mean, what are we supposed to say…[pauses]

Marc: ….here's the description (referring to slide on laptop screen)

Alana: Okay.

Ian: [reads from screen] More carbon dioxide…[interrupted by Marc]

Marc: Wait, are we supposed to draw a picture? [begins reading directions quickly

from the directions on a worksheet]

Ian: No, let's go back to the slides where…[pauses]. Let's go back to the pictures…

Alana: No.

Ian: Okay.

Group is seen writing individually in packets of worksheets.

Marc: Do I just make like 2 jars? (referring to drawing)

Alana: I guess.

Ian walks over to the laptop setting between Alana and Marc and goes back to a previous slide.

In this example, Ian took advantage of a break in group talk as well as a question posed by Marc to justify his taking control of the task tools to return to information that Alana opposed the group reviewing. Similarly, Shonyce and Ty of Group F and Greg of Group C all at various points asserted that they needed to use the group laptop when a groupmate was in control of the tool; for all three students, gaining control of a scarce task tool opened the door toward centrality during the episode. In Greg's case, he leveraged the scarcity of the laptop to reduce Leesha's frustration with him and rejection of him, while in Shonyce and Ty's cases they leveraged the laptop's scarcity to gain influence over group decisions.

Managing constrained participation. Managing constrained participation functioned as a means of coping with repeated ignoring or rejection, unresponsiveness to requests for help, or contributions to on- or off-task discussion. This was the most frequently observed function of managing constrained participation across all groups. In Group B, Ian regularly managed constrained participation to deal with repeated rejection. In one episode, Alana put pressure on Ian in the presence of the teacher to get him to accept her answer as his own on a worksheet:

Ian: HIV is…[interrupted by Alana]

Alana: SIV and FIV are the same thing as HIV and…[interrupted by Ian]

Ian: They're similar except HIV is for humans and SIV is for animals and right now we're studying humans, so…

Alana: That's what I just said, soooooo…yeah, it does exist. It's unlikely to get

it, but it does exist. [Pauses] And the other reason I said that is better is

because the path to "studies does not exist" strongly contradicts and for

"does exist at the area clinic" just contradicts, not strongly contradicts. So

there's more that supports than contradicts.

Ian: Oh-kay.

Alana: [Pauses] So, I don't know if you wanna change your *arrows* or anything,

or like your ratings. [sarcastic tone]

Ian: I don't really care.

Alana: Here's a red pen. [throws pen at Ian across table]

Ian: Okay.

Alana: [Pauses] So, do you have anything that supports yours?

Ian: Not yet. I just started (frustrated tone). Like always…

Teacher comes over to group and asks, "Can I see your work, please?" to Ian.

Ian: I'm still trying to do this. [Teacher says, "Okay, but you have to decide

something"]

Alana: I just explained it to him.

Ian: I'm trying to support *mine*! (frustrated tone)

Teacher walks away and begins speaking to whole class.

Alana: (to Jacki) What are you writing?

Jacki: What you said, except I changed [inaudible].

Alana: So you have Model 1?

Jacki: Yeah.

Ian is seen writing on his own.

Ian: Wait…[continues turning pages in his packet]. Fine. [slaps pencil onto table and grabs red pen]

In this episode which dominated an observation for Group B, tension rose until Ian gave up on trying to explain his position. Throughout the episode Alana raised the stakes of his incorrectness by taking a competitive tone, self-presenting in front of the teacher, and then rallying Jacki, who typically wasn't engaged by the group, to publicly emphasize that multiple people disagreed with Ian. Ian managed constrained participation throughout by stating that he did not care about Alana's input, shifting to individual work, taking an increasingly hostile tone, and finally giving up to just write down the answer Alana suggested. Similarly, Lauren of Group A managed constrained participation during an observation in which Jacob and Arjuna ignored her consistently. Lauren talked to students outside of the group and then resorted to talking to herself and working alone ("What does this mean? [pause] "What the hell does this mean?" before shifting to working alone). In another instance of managing constrained participation to deal with ignoring, Patrick eventually joined the off-task conversation after being ignored and talked over every time he tried to initiate on-task activity.

The third function of managing constrained participation was to deal with isolation as a result of a lack of cohesion in the group. In one example, Patrick of Group D was seen playing with pencils on the table as Shane and Necha shared an off-task exchange which did not include him. Similarly, during most of Group B's observation time Jacki managed constrained participation as she stood appearing as an observer

during her group's activities, never making a spoken contribution and only making other non-verbal contributions when the teacher directly addressed Jacki within the group.

Summary. All groups employed a variety of acts of agency. Group members also were able to make use of other marginal group members' acts of agency in their own attempts to leverage resources. For example, Shonyce built upon Rania's acts of agency to leverage communication skills and call out Ty's behavior as rude. During on-task activity, marginal students used social resources more often than academic ones. This is reflected in the dominance of leveraging humor and off-task talk among the seven acts of agency observed. Nonetheless, while humor and off-task talk were what was leveraged, students often used this resource to segue into on-task activity. Success rates also varied across interaction types, which suggests there are qualitative differences between the acts of agency in terms of long-term effects. Study 2B will further address this issue.

Study 2B: Acts of Agency and Trajectories of Marginality

Study 2B's aim was to examine the relationship between acts of agency exercised by marginal group members across observations and their trajectories of marginality across the semester. For each student, marginality ratings for each observation were organized chronologically and a line graph was constructed; this was paired with a qualitative analysis of each student's inclusion in the group across observations to inform a decision as to whether the student's trajectory was inbound or outbound. An *inbound trajectory* was one in which the student became increasingly included and integrated into the group's functioning over the semester whereas an *outbound trajectory* was one in which the student became less included and less integrated in the group's functioning

over the semester. In this section, four students will be profiled to highlight the acts of

agency that correspond with the two trajectories (See Tables 8 & 9). The four students

include two with inbound trajectories and two with outbound trajectories. The four

profiled students were selected for representativeness of their corresponding trajectory

types (i.e. inbound and outbound).

Inbound – Arjuna (Group A). Arjuna's marginality declined over the semester

and overall was moderate or low in intensity across all observations where he became

marginal. Arjuna also had a low frequency of marginality episodes: he was marginal in

two out of four observations. Unlike the three other students profiled in this paper,

Arjuna was reported to have very high academic status by classmates and his groupmates

in end-of-semester interviews. During Group A's observations, Arjuna was also

identified as being frequently called on by the teacher. Arjuna's high academic standing

in the classroom became relevant to both how he became marginal as well as how he

enacted agency in the face of marginality. The first episode of marginality for Arjuna

was during Group A's first observation. During this observation, Lauren engaged in a

great deal of off-task talk mocking Arjuna's interest in the subject of sheep reproducing.

Arjuna appeared oblivious to what Lauren found so funny until Lauren became more

overt in her mocking of Arjuna:

Arjuna is operating the laptop.

Lauren: Oh my gosh, can you stop being like….(laughs)

Arjuna: (laughs)

Lauren: I don't want to see sheep having…

Arjuna: Oh my gosh, it has a black face with white fur!

Jacob: (to Lauren) You don't have to, they took the nucleus (does air

quotes gesture)

Arjuna: Oh! They planted it in that guy!

Lauren: I don't wanna see the babies. I don't wanna see them making babies!

Arjuna: No, they took two males, put it together, and then put it in one female.

Jacob: See, that's Dolly. Cause they took a white sheep and a black sheep and

got a gray sheep! (laughs)

Lauren: Dolly's a female! Dolly's a female, not a male!

Arjuna: No, they took one male nucleus, one male cell, combined together with

one female, and then made a female sheep!

Lauren initially pushed the discussion toward nominally on-task topics, yet Arjuna was

still interested in the content of the task itself. He leveraged communication and social

skills to clarify how Dolly was produced, yet Lauren continued pushing the group away

from on-task discussion of the topic. As the group looked at information on the group

laptop about Dolly the sheep and Lauren attempted to shift the discussion off-task,

Arjuna joined without fully seeing where Lauren's joke was going. He later faced more

overt ridicule from Lauren and Jacob:

Jacob: Maybe that's the male and that's the female. We'll go with that. Cause

that one's more pink! (laughs)

Lauren: Oh my god. That's disgusting. *Lauren clicks to move to the next slide on*

the computer. Arjuna laughs and goes back to the slide Lauren clicked

away from. Arjuna, there's something mentally wrong with you.

Arjuna: What does this tell you for the nucleus (laughs)

Jacob: (laughs) He's enjoying this.

Lauren: (to Arjuna) What are you doing, eh?

Arjuna: (laughs) What do you conclude from this evidence?

By the end of the observation, Lauren escalated the ridicule further, making broader personal attacks with gender-relevant undertones:

Arjuna: I don't like One Direction. I only picked it because I hate, I don't like Justin Bieber.

Lauren: DON'T…start with my husband.

Jacob: (laughs)

Arjuna: (sighs)

Lauren: (to a student outside the group) You know what, something's wrong with him, he likes One Direction…

Arjuna: No I don't! I just said that cause I don't like Justin Bieber!

Lauren: (to student outside group) No, but he's a guy. (laughs) He also wants to dissect the frog…

Arjuna begins packing his materials to leave class. He walks away from the table briefly and then returns.

Lauren: That was disgusting. But Arjuna liked it of course. You really like those pictures? You really like that evidence?

Arjuna: That isn't disgusting.

Lauren: Then why were you staring at it?

Arjuna: I wasn't staring at it! I need to get the information to do good in it.

Lauren: You were staring at the pictures.

Arjuna walks away.

Initially, Arjuna leveraged communication and social skills to explain his point of view, but it became clear that Lauren was not concerned with his clarifications and was instead making fun of him. He then shifted to managing constrained participation by walking away from the group and explaining away the situation. The observation ended with Lauren still mocking him.

In Group A's second observation, Arjuna was not marginal. Instead, Lauren and Jacob were marginal, with Lauren's marginality being the more severe of the two. As in the first observation, Arjuna controlled the task tools, but in this observation Arjuna did not respond to any of Lauren's off-task commentary and jokes. When Lauren leveraged communication and social skills by telling Arjuna that he needed to share the laptop so they could work as a group, he ignored her. Jacob stayed on-task and worked with Arjuna, crouching on the floor to see the laptop screen. Arjuna directed his on-task comments to Jacob, again ignoring Lauren. Further, Lauren's participation was not solicited to bring her back into group activity. Arjuna showed frustration toward Lauren with an irritated tone and dismissiveness. He also resorted to directing his comments to Jacob exclusively.

Throughout Group A's second observation Arjuna avoided interacting with Lauren, even after she explicitly stated that the group needed to work together. He managed to avoid working with her by working almost exclusively with Jacob and ignoring her commentary about both on- and off-task topics. When Lauren leveraged communication and social skills to position herself as a help seeker, neither Arjuna nor Jacob responded. The few times that Arjuna did respond to Lauren, he took an irritated

tone with her. Unlike Group A's first observation, in this second observation Arjuna did not respond to any of Lauren's off-task comments related to the content. In light of how Lauren partnered with Jacob to use off-task talk to increase Arjuna's marginality in the first observation, Arjuna's working with Jacob and simultaneous ignoring of Lauren may partially explain how Arjuna avoided marginality in the second observation.

During the third observation, as well, Arjuna was not marginal. He largely worked individually. Additionally, neither Lauren nor Jacob were marginal during the third observation. Lauren and Jacob worked together, although Arjuna interjected occasionally once he had completed his own work alone:

> Jacob: (reading from worksheet) Read the article…check. In groups discuss what, what do you conclude from the study. I don't really know! Did they mutate?
>
> Lauren: Alright, now look at page 8.
>
> Arjuna: Done, done, done.
>
> Jacob: Like, does it happen naturally? Or do they do something to the frog?
>
> Arjuna: They didn't do anything to the frogs, it happens naturally.
>
> Jacob: So, so why are they weird?
>
> Lauren: Based on our packet, they look like aliens. They're aliens.
>
> Jacob: That doesn't make sense.
>
> Lauren: (To Arjuna) They're baby aliens.
>
> Arjuna: Frogs are green and aliens ARE green!
>
> *Lauren and Arjuna go into extensive off-task talk about aliens.*

Here, Arjuna worked individually and then joined off-task talk that was not hostile

toward him since he was no longer actually engaged in the task. Unlike his interactions

with Lauren in the first observation, Arjuna did not spend time addressing her joking

comments with seriousness. Yet, this left Jacob unengaged by the group since he was

focused on completing the task. In Group A's fourth and final observation, Arjuna's

marginality was rated low. Arjuna offered inappropriate ideas about how the group

should evaluate the models and Jacob reminded him not to focus on superficial features

of the models. Arjuna also unsuccessfully leveraged humor and off-task talk:

> *Jacob and Lauren are talking about an outside of class project.*
>
> Jacob: She's gonna keep our cell model.
>
> Lauren: Who the hell would want that?
>
> Jacob: I dunno, I don't want it. [Pauses] (to Lauren) You should've kept it.
>
> Lauren: Me? I would've burned it.
>
> Arjuna: That would've been fun.
>
> Jacob: Put it in the microwave (laughs)
>
> Lauren: Yeah, like Alana (laughs)
>
> Arjuna: That'd be a pretty good idea. Burning something. [pauses] Burning
>
>> things.

Lauren and Jacob ignored Arjuna as he attempted to leverage humor and off-task talk.

Jacob proceeded to change the topic which led to a blaming of Arjuna for the group being

video recorded. Arjuna leveraged communication and social skills by correcting the

misrepresentation of the situation and advocating for himself. Across Group A's fourth

observation Arjuna was only mildly marginal. He faced few barriers to his continued

participation, regardless of whether he had previously been ignored or ridiculed. Further, he was reintegrated into the group by the end of the observation.

Across the semester, Arjuna's trajectory was inbound: during two out of four observations he was not marginal at all and in the remaining two observations his marginality was low. His marginality decreased from the beginning of the semester until the end. In Group A as well as his class, Arjuna held high academic status and was known by others to be a "smart" student and an influential contributor in his group. Arjuna was largely central to his group because of his ability to contribute to progressing the task, but he became marginal during off-task episodes. The only off-task episode in which he was not marginal was an episode where Lauren solicited him for off-task talk and ignored a question Jacob had asked about the task. Arjuna was known to get answers right in his class and exerted influence in his group by correcting his groupmates and being able to elaborate ideas; thus, he was persistently central when the group answered task questions. Nonetheless, he became marginal when answering questions ceased to be the focus; his groupmates did not take interest in his jokes and instead ignored him or made him into the joke.

Inbound – Carson (Group C). Across observations, Carson was observed to at first become increasingly marginal with a sharp decrease in his marginality by the end of the semester. Carson's acts of agency focused primarily on leveraging humor and off-task talk and a theme of Carson entertaining his three groupmates emerged from the first observation and continued until the end of the semester. He also leveraged status hierarchies at the peak of his marginality, which soon became identifiable as part of his strategy to ensure that he got answers from his groupmates, Luke and Leesha, as well as

his other classmates despite his heavily off-task activity. At the start of the semester, Carson emerged as an entertainer during a slow-paced task. To deal with the problem of a scarce task tool being operated by Luke and only visible to Leesha, Carson took an over-the-top approach by leveraging humor and off-task talk: he climbed onto the table rather than ask for Luke or Leesha to share the tools. Luke responded with disbelief at Carson's behavior, simply saying "Really?" By doing this, Carson initiated a tone of humor in the group, as was evident in the remainder of the observation as well:

Leesha: (sighs)

Carson: Oh my gosh, could you guys make this thing go ANY slower?

Luke (laughing): I just realized it's the same thing circling over and over

Carson: Are you serious? You've been watching the same PowerPoint over and

over? Oh my god, you gotta be kidding me, Lucas.

Throughout the remainder of the observation, Carson continued to take a sarcastic tone. At various points, Leesha and Luke laughed at his jokes and Greg attempted to join in on Carson's entertainment of the group. Nonetheless, as the semester progressed and more demanding tasks were offered, Leesha and Luke appeared less entertained by Carson and more to be merely tolerating him. In the second observation, Carson had to adopt a new approach:

Carson: Wait, what page are we ON?

Leesha (pointing): THIS PAGE!

Carson: You guys tell me go back a page, now you're (interrupted by Leesha)

(humor/off-task)

Leesha: NOW WE FLIP THE PAGE (speaking slowly)

Carson: Oh, do we?

As tension rose, Carson adapted his entertainer role to incorporate leveraging communication and social skills by positioning himself as a help seeker. By asking questions, Carson avoided appearing lost or off-task and also put pressure on Leesha and Luke to actually interact with him, even if they were frustrated with his frequent off-task activity. By Group C's third observation, their frustration with Carson peaked and so did Carson's marginality:

Group is seated at a table, each student next to his/her pairwork partner. Luke and Leesha are working together, not interacting with Greg and Carson. Carson and Greg are not working on the task. Carson reaches across and takes Luke's worksheet packet when Luke isn't looking. Luke yells, "Carson!" Luke gets up and takes his paper back.

Carson: We're supposed to be doing it as a group! (looking at Luke) Complete

with group! (with staccato)

Luke: PARTNER.

Carson: She said group. So hello group! She said group.

Leesha: You have to list one of your rules, too.

Carson: Yeah, and I ain't got none, so what's your rules?

Whereas Luke and Leesha previously continued to engage Carson despite his frequent off-task activity, Carson's actions became intolerable during the third observation for Group C. Luke pushed back by retrieving his work and then taking a firm stance against working with Carson. Even Carson's leveraging of external authority to justify his actions did not work at this point. To deal with his compromised relationship with Leesha, Carson shifted to leveraging status hierarchies in the fourth observation. He took advantage of the fact that Greg was not a very well-received member of the group at this point:

Luke: Do you hate him? (to Carson, pointing at Greg)

Carson: What?

Luke: Do you hate him?

Carson: Yeah. (Luke laughs)

Luke: (to Greg) Well, I'm not in your math class.

Carson makes a joke, giving Luke a nickname based on his last name Luke laughs

Despite his recent rocky interactions with Luke, Carson was able to ease some of the

tension by taking an opportunity to shift the focus onto Greg since Luke and Leesha had

recently expressed irritation with Greg during the third observation. By leveraging status

hierarchies against Greg, Carson improved his standing with Luke, from whom he

regularly sought answers. Eventually, Carson had developed a means to avoid

marginality entirely. In the fifth and final observation, Carson had zero episodes of

marginality, yet was a catalyst for Luke and Leesha's episodes of marginality. In the

following excerpt, Carson's reliance on Luke for answers turned into an experience of

marginality for Luke:

> *Carson begins reading the directions from the packet.*
>
> Carson: Well, I say…(pauses and stares at Luke)
>
> Luke: Oh, okay, now you're going to the Asian, okay.
>
> Carson: Well, why wouldn't I? *Leesha snaps fingers at Luke*
>
> Luke: I'm reading.
>
> Carson: Wait, did you say something Luke? You're definitely right. Just, just,
>
>   you're right.

While Luke was the first one to mention anything related to ethnicity during this

observation, Carson did not contest Luke's accusation and pursued it as a basis for

furthering a joke at Luke's expense. Leesha also joined in by snapping her fingers at Luke, encouraging him to come up with answers faster. Carson was able to maintain his end goal of getting answers from Luke, as Luke continued searching for answers for the group, rather than with the aid of the group. The impact of Carson's reliance on Luke was also reflected in Luke's end of semester interview.

Over the course of the semester, Carson worked his way in and out of marginality. Initially, Carson was not given consideration in terms of ensuring he had access to the task tools, and he responded to this indirectly by leveraging humor and off-task talk, rather than pointing out that Leesha and Luke had not included him. Later, Luke and Leesha became frustrated with Carson, so he developed new ways to require their engagement with him: positioning himself as a help seeker and tapping into their frustration with Greg by leveraging status hierarchies. Finally, Carson avoided marginality for an entire observation by shifting the focus of his jokes to group members who had been central to on-task activity for the entire semester.

Carson's inbound trajectory was linked to his responsiveness to the group's perceptions of him as deserving or undeserving of assistance and his own willingness to leverage status hierarchies for his personal benefit. Nonetheless, this inbound trajectory was limited: Carson never actually became a serious contributor to on-task activity, nor did he achieve a form of centrality in group activity that was based on mutual respect or valuing of all group members' contributions. Thus, while it appears that Carson achieved centrality in the group's activity, his centrality appeared to only be possible when the group was kept off-task or otherwise distracted from the task.

Outbound – Greg (Group C). Unlike his pairwork partner Carson, Group C's Greg's marginality began at the beginning of the semester and did not improve over the semester. Greg was observed to at first become increasingly marginal, peaking at the middle of the semester; by the end of the semester Greg was observed in moderate-to-low marginality that was sustained by his withdrawal of participation. Greg's acts of agency focused primarily on leveraging humor and off-task talk. For much of the semester he attempted to join in on Carson's leveraging of humor and off-task talk. Nonetheless, his attempts to join in on Carson's entertainment of the group were increasingly unsuccessful and eventually turned into Greg simply laughing at Carson's jokes or explaining away his situation if he was the target of a joke. During Group C's first observation, Greg was seen tagging along in Carson's leveraging humor and off-task talk. First he made faces and stared at Luke as Carson climbed onto the table when neither Greg or Carson could see the laptop; then, Greg followed Carson's lead to go back into pairwork:

Carson gets off of the table.

> Carson: Come on [Greg], let's answer this question.
>
> *Greg walks back to his side of the table.*
>
> Luke: Ohhh, it's repeat experiment!

Carson grabs the laptop from in front of Luke and puts it on the other side of the table. Luke reaches to take the laptop back and then stops. Carson operates the laptop, which is placed between Greg and himself.

Through this entire observation, Greg watched Carson and followed Carson's lead by leveraging humor and off-task talk. Further, all of Greg's leveraging humor and off-task talk followed an initiation by Carson. As can be seen in the previous excerpt, Carson to

some degree welcomed Greg's acts, but Luke and Leesha did not respond to Greg's leveraging humor and off-task talk. In the second observation, Greg again connected to the group through by tagging along in Carson's off-task activities, but Leesha became visibly irritated with Greg. In resposne, Greg leveraged communication and social skills to position himself as a help seeker and avoid being pushed out of group activity:

> *Greg returns to the group, approaching Carson.*
>
> Carson (with sarcastic tone): [Greg] you're not gonna be able to jump in because we're just too far ahead! (Greg laughs)
>
> Leesha begins reading directions from the packet.
>
> Carson: Can you re-read that?
>
> Leesha: It's not that hard, you can read it on your own (Carson starts reading aloud)
>
> Leesha: Okay, we have to do this individually. So go away. (to Carson and Greg)
>
> Carson: Can you move this computer so I can write?
>
> *Greg moves next to Leesha near the laptop.*
>
> Leesha: [Greeeeeeeg] go awaaaaaay!
>
> Greg: I need to do this!

Greg returned to the group and was brought into Carson's leveraging humor and off-task talk immediately as Carson involved him in a joke; Greg embraced Carson's solicitation. Leesha used the task's individualized structure to evade working with Greg and Carson. She also appealed to the task structure to get the two out of her physical area. Greg responded to Leesha by leveraging scarce task tools, emphasizing that he needed to stay near Leesha in order to use the group laptop ("I need to do this!"). Additionally, Greg's

Carson when to leverage humor and off-task talk was challenged for the first during the second observation:

> *Leesha, Carson, and Luke are all on one side of the table. Greg is seated opposite Leesha. Leesha is going back and forth with Carson about why he needs to explain his own opinion after Carson asks Leesha and Luke for their explanations as he is writing on his worksheet.*
>
> Greg: Hey, Luke…are you mediocre?
>
> Luke: No…I don't know what that means.
>
> Carson: Why because I said mediocre, now you're saying mediocre? That's not cool.
>
> Greg: Sorry…[pauses] I shouldn't have said that.
>
> *Leesha takes away the laptop as Greg is working with it.*
>
> Greg: Nooooooooooo, I was almost done.
>
> Leesha: Sorry, I need to see something! (Luke leans over to look at the laptop screen, Greg sits with his hand outstretched waiting for the laptop) Okay, you can have it back.

Carson leveraged status hierarchies against Greg; Greg leveraged status hierarchies in return, but showing deference to Carson. Later in the same observation, Greg unsuccessfully leveraged humor and off-task talk again by making jokes about White-Out smelling good and asking Leesha to let him smell it. None of his groupmates responded to his joke and Leesha responded flatly with a "no". The second observation highlighted two things about how Greg enacted agency: he relied heavily on a partner, Carson, and

the efficacy of his acts of agency was often reduced by how poorly his acts of agency fit into his interactions with Leesha and Luke. Nonetheless, by the third observation, Greg's lack of responsiveness to the environment was clear and had come to firmly include his interactions with Carson as well. First, Greg made a poorly-timed joke about Leesha's criticism of Carson and himself. Leesha was very frustrated with both Carson and Greg:

Group is seated at a table, each student next to his/her pairwork partner. Luke and Leesha are working together, not interacting with Greg and Carson. Carson and Greg are not working on the task. Carson reaches across and takes Luke's worksheet packet when Luke isn't looking.

Leesha: I love how you guys aren't even doing ANYTHING, YET you copy off of me.

Luke: [Carson]!

Greg (looking at Carson, pointing at Leesha): She even said LOVE.

Leesha: I was being sarcastic.

Leesha's frustration escalated further as the observation progressed. Fed up with Greg, who she identified as a non-contributor, she attempted to prove that Greg indeed was not contributing. She was notably displeased with what she found:

Leesha grabs Greg's packet while he's not looking.

Leesha: I have [Greg]'s paper so it doesn't matter.

She and Luke read it together. He reaches to get it back when he notices she took it.

Leesha (throwing packet at Greg): Your rules are too awful for me.

Luke and Leesha go back to working together. Carson returns to his seat and writes a little bit before returning to completely off-task activity. Greg laughs at him.

After confirming that Greg's work indeed did not meet her standards of being a valued contribution, Leesha insulted Greg's work explicitly, questioned his competence implicitly, and then shifted into pairwork, avoiding further interaction with Greg. Despite Leesha's visible rejection of Greg as a collaborator, Greg continued to align with Carson, who Leesha also had accused of failing to contribute and outright copying her work. In this step, Greg positioned himself as a willful non-contributor without much room to change his image within the group. This backfired when Carson opted to leverage status against Greg in the fourth observation, as was discussed in Carson's profile. More important, Greg had already been rejected by Leesha in the fourth observation as she shouted that she did not care what he had to say and was no longer listening to him; Luke joined her by ignoring Greg's solicitations and mocking him. During the same observation, Carson unaligned himself with Greg, as well. Greg here had multiple pathways to inclusion closed off to him: Leesha asserted that she would no longer listen to Greg talk and then Luke openly refused to engage with Greg. Finally, Carson joined in the rejection of Greg, unaligning himself with the least well-received group member. Greg was gradually losing his ability connect with the group successfully.

In Group C's fifth and final observation, Greg had developed a new approach to the group entirely. Rather than attempting to entertain the group like Carson, Greg kept his verbal contributions minimal and only laughed at others' jokes rather than leveraging humor and off-task talk on his own. Further, for the second time, Greg's competence was questioned publicly, this time by Luke. The following episode occurred as the group read a question from a worksheet during the unit on evolution:

> Greg: Turtle? How is a turtle related to a horse? Turtles have shells (interrupted by Luke)

> Luke: DISTANTLY. RELATED. You know what "distantly" means?! Like far, far away *(Greg says "Yes")*? That still counts as being related.

> Greg: That's not far. That's not that far.

> *Luke laughs at Greg. Greg plays with pens on the table silently.*

At this point, Greg managed constrained participation by withdrawing from group talk. He did not speak again until the topic changed to a non-academic, off-task discussion of Leesha's ethnic background. While Greg's marginality rating for the fifth observation was lower than in the preceding observations, this episode depicted how Greg may have kept himself at a state of low-to-moderate marginality as a strategy to avoid full-on marginalization at the hands of an unwelcoming group. Thus, Greg's low marginality rating within a single observation only represented his solidifying marginal position in the group rather than a truly inbound trajectory. Over the course of the semester, Greg gradually moved into the margins of activity. Greg first used Carson's off-task activity as a resource for his own inclusion, yet later resorted to managing constrained

participation to avoid harsh rejection. Greg stopped attempting to facilitate his own inclusion.

Outbound – Shonyce (Group F). Group F was the only group selected for inclusion in the sample in which the group's composition changed over the course of the semester. Initially, the group had two girls, Rania and Shonyce, although by the end Rania had been replaced by a boy, Paul. For Shonyce, the removal of Rania appeared relevant to her trajectory since her marginality increased sharply after Rania left the group in the second observation. In the first observation, Shonyce, Rania, Ty, and Jivan worked together on a task involving use of the group laptop. Initially, Shonyce, Ty, and Jivan discussed roles for operating the laptop. This appeared to be part of a routine the group had developed for when they used the laptop. In this first observation for Group F, Shonyce became marginal when she lost access to the task tools. She quickly leveraged scarce task tools to correct this ("No! I can't see that!" while grabbing the laptop to move it within her reach). Her leveraging of scarce task tools was effective in that her groupmate, Jivan, responded by compromising with her to place the laptop in a location accessible to both himself and Shonyce. Further, many of her acts of agency involved her coming to the defense of Rania when Ty talked in a condescending way toward her. In one example, Shonyce leveraged status hierarchies to defend Rania from Ty's accusations of cheating:

Rania: [Shonyce], is this right?

Shonyce: (reaching toward Rania) Let me see.

Ty: Don't copy.

Rania: I'm not copying word for word!

Shonyce: Stop doing that! Jeez, she's not doing it. She's not DUMB. She's on the

honor roll!

Rania: I wasn't this time. (laughs)

Shonyce: (laughs)

Ty: It's called "cooperative learning", not "cooperative cheating". (laughs)

Shonyce's alliance with Rania continued through the observation. Their alliance was

mostly based on a shared frustration with Ty's behavior. Shonyce's problem with Ty's

tone continued throughout the observation. She was vocal about her frustration:

Shonyce is seen writing in a packet of worksheet.

Jivan: [Shonyce], stop doing your homework in science.

Shonyce: I'm not doing my homework in science, I'm doing the packet! (waves

packet in Jivan's face)

Ty: Well, you do do it sometimes.

Shonyce: [pauses] (to Ty) Don't be such a bully. (laughs) You're so rude. (To

Rania)

Do you see how men treat us? Ha, m-men! (laughs)

Despite Shonyce's frustration with her pairwork partner, Ty, the tone was fairly light

during the observation and laughter was common among all group members. Later, Ty

took a condescending tone when explaining his reasoning about an answer to her and she

responded by saying, "I didn't say that! Stop yelling at me!", and then pretending to cry.

Despite Shonyce's momentary marginality at various times in the first Group F

observation, Shonyce demonstrated that she could successfully leverage communication

and social skills, status hierarchies, and scarce task tools to ensure she retained access to

the task for the most part. Yet, in the second observation, Shonyce's success with acts of agency declined sharply. This second observation was the first in which Rania was absent and the first in which Paul was present. Shonyce's involvement was reduced to that of merely a subject for evaluation by her groupmates Paul, Ty, and Jivan:

Jivan: What'd you choose?

Paul: They're different….

Shonyce: …or just 1 and number 2. 2. (laughs)

Paul: Which one do you have?

Ty: Did you choose number 1 or number 2?

Shonyce: Yeah? (to Ty)

Paul: Which one did you put?

Shonyce: I choose, ummm, model number 2.

Paul: Which one do you have right now? Number 2 right now?

Shonyce: I put number 1….Number 2 (with emphasis, pointing at her paper).

Jivan: (takes packet from Shonyce, reading quietly) One…

Ty: Dude, just look, gimme it (grabbing for Shonyce's packet from Jivan unsuccessfully)

Paul: Right at the beginning

Camera pans away from group briefly

Paul: (camera away when Paul gets packet) (inaudible) You have to pick model 1. (looking at Shonyce's packet)

Importantly, Shonyce was the only group member subjected to evaluation by the group without having the opportunity to mutually evaluate her groupmates' work. Later in the

second observation, Paul and Ty had a disagreement about whether HIV was a disease or

not. Shonyce and Jivan watched. Once Ty and Paul stopped going back and forth about

content details, Paul turned to Jivan and Shonyce, deliberately ending his exchange with

J. Paul began explaining that his worksheet packet was falling apart and Shonyce

leveraged communication and social skills, reaching her hand out and asking to see the

pages ("Here, let me see" while waving her hand across the table). Paul ignored Shonyce

entirely and continued talking to Jivan. Shonyce managed constrained participation by

temporarily withdrawing from group activity and spinning a pen on the desk. Moments

later, Shonyce rejoined group activity via off-task discussion:

Shonyce: That's messed up.

Paul is whistling

Shonyce: No, tell me where her stapler is. (looking at Jivan, shifts to looking at

Ty)

Jivan: I thought you said you changed…

Paul: Yeah,[J], why are you still talking about [Shonyce]? And why are you still

talking about (inaudible)

Ty: Yeah, why are you saying (inaudible)

Paul: (interrupting Ty) Because we don't…

Jivan: (interrupting Paul) Because we don't want to argue.

Paul: We're supposed to argue about this, not other people!

Jivan: Yeah!

Shonyce leveraged humor and off-task talk to re-engage the group, this time telling Jivan

to give another student her stapler back. This shift to off-task talk was continued by Paul

who questioned Ty's competitive approach to groupwork. Paul and Jivan singled Ty out, taking a condescending tone after Ty had earlier had a highly competitive exchange with Paul in which Paul was shown to have an incorrect understanding. Here, there was a less supportive atmosphere for Shonyce as she was subjected to evaluation in ways that her groupmates were not; Shonyce for the first time was fully ignored by a groupmate and managed constrained participation. Nonetheless, Shonyce engaged with the group continually. In the third observation, tension between Shonyce and her pairwork partner, Ty, became more visible in group activity. Shonyce came to Ty's defense as Paul talked over Ty. Yet when the opportunity arose Ty joined off-task talk that focused unwanted attention on Shonyce's appearance:

Shonyce: What do you mean?

Paul: Small hairs right there

T blocks camera.

Shonyce: (claps) (to Jivan) Stop it.

Ty: (Looks at Shonyce and rubs the area between his eyebrows)

Shonyce takes Ty's pencil from the table and throws it on the floor while looking

at Ty.

Paul: You really do, we're not lying to you.

Jivan: We're not lying!

Paul: She has like small hairs. (pointing to area between his eyebrows) A lot of

people do.

Shonyce: I WOULD stab you, but I can't reach you. (blinks repeatedly, then

shakes head)

Shonyce responded to her three groupmates' unsolicited commentary by managing constrained participation, displaying aggression. As the observation continued, on-task discussion involved the collective correction of Shonyce by Ty, Jivan, and Paul. In this excerpt, the group was working on a worksheet involving the creation of models:

Shonyce: Moving on…

Jivan: Both have genes…

Shonyce: Both have predators because all *(Ty, Tyivan, and Paul interrupt simultaneously, talking over one another)*

Ty: Uh, they're technically not predators *(looking at Shonyce)*

Shonyce leans back and breaths loudly

Paul: *(Interrupting Ty)* Yeah, pollute-they're not a predator *(looking at Shonyce)*

Before Shonyce could completely state her own reasons, all three of her groupmates interrupted her and talked over her; they prioritized correcting her ideas over hearing her full explanation. Shonyce again managed constrained participation as was evidenced by her exasperated body language. Shonyce managed to rejoin on-task discussion later in the observation nonetheless. More strikingly, though, Shonyce also began leveraging humor and off-task talk as well as status hierarchies. Shonyce targeted Ty, who she had defended earlier in the observation:

Shonyce: Dang it, I can't do it right! *(aiming at Ty's hand [where he's resting his head], she tries repeatedly to hit Ty with the pen)*

Paul: *(gestures demonstrating how to snap the pen at Ty)* Wa-chhhh! (snapping sound effect). *Shonyce imitates Paul's gesture to snap Ty, Ty winces and leans*

away, covering more of his face with his hand in anticipation.

Ty: Nooo! (pause) *Shonyce snaps Ty with the pen.* OWWW! Ty *pulls hand away, Shonyce laughs and looks at Paul before putting her head down still laughing, Jivan and Paul also laugh.* It has to be the thumb ….can't do it on the knuckles, that's okay. Can feel the knuckles so that's okay.

Shonyce: I'm sorry, Ty. *(laughing)*

Shonyce was able to leverage status hierarchies as well as humor and off-task talk again Ty partially because of Paul, a more central member, supporting her moves. Tension had already surfaced between Paul and Ty, so Shonyce's willingness to make him the center of a joke was welcomed. This shift to a focus on Ty in the group continued and Shonyce again leveraged status hierarchies to mock Ty for his answer:

T is in the background giving instructions. Paul and Shonyce raise their hands and says the group needs more time when T asks whole class.

Ty: No, we…

Jivan: We finished!

Shonyce: No, we don't have 13! (looking at Jivan's paper)

Paul: No, you wrote something stupid! (To Ty) (laughs)

Ty: (laughs)

Shonyce: (looking at Ty's paper) Ty doesn't even have number 13.

Paul: You wrote that.

Shonyce: Yeah, he wrote….

Paul: (Interrupting Shonyce) You wrote something stupid! "The animals died"…that's so smart, [J], that's so smart. (laughing)

Shonyce: (Interrupted by Paul, talking at the same time as Paul) (looking at

Jivan's paper) He wrote….and he wrote something that is stupid (pointing

to Ty's paper)

J initially responded with laughter, although he was no longer laughing when Shonyce took his pencil and began erasing his work. Ty then took a pencil and made marks on Shonyce's paper, to which she responded by leveraging communication and social skills. She said "Stop" to explicitly identify the unwanted behavior. Across this third and final observation, Shonyce's marginality was severe, specifically because of the frequency of direct moves that increased her marginality by her groupmates. Further, her groupmates worked together to push her ideas out of on-task discussion and they also worked together to direct unwanted negative attention toward her during off-task talk. Shonyce managed constrained participation on multiple occasions, but nonetheless was very involved in acts of agency that would reduce her marginality. She leveraged status hierarchies to refocus the group's negative interactions onto Ty rather than herself and she also jumped into on-task discussion with ideas when possible despite facing criticism for her contributions.

Overall, Shonyce's trajectory was outbound due to the increase in the extent of her marginality as the semester progressed. One thing that appeared to have contributed to this increase in her marginality was the shift in group membership. While Rania was in the group, Shonyce allied with her to buffer against Ty's critical and condescending commentary. Further, Jivan acted as a mediator when disagreements between Ty and Shonyce intensified: at one point, Jivan explicitly told the two to stop arguing over who would control the group laptop and encouraged them to focus on the task. Yet, when the

group's membership changed, Jivan became an antagonist rather than a mediator. He and his pairwork partner, Paul, regularly worked together to dismiss and disrespect Ty. Further, Ty at times joined Jivan and Paul to turn the focus of disrespect onto Shonyce. The flimsy alliance between Ty and the other two boys in the group was in addition to Ty's consistently critical and condescending leveraging of status hierarchies when Shonyce made contributions. With Rania gone, Jivan and Paul focused on reducing Ty's influence. Additionally, with Ty's leveraging of status hierarchies against Shonyce, Shonyce was largely left to her own devices to function within a competitive group environment. She only occasionally had support from a groupmate and it was only when she showed disrespect toward Ty. This left little prospect for Shonyce herself becoming central to group activity.

Summary: Inbound and Outbound Trajectories. The students profiled here came from groups with varied compositions in terms of gender and number; groups also had varied interactional dynamics. Nonetheless, some commonalities emerged from the examination of students with inbound trajectories versus those with outbound trajectories. The two inbound students, Arjuna (Group A) and Carson (Group C), varied in the types of acts of agency that dominated their repertoires: all seven acts of agency were represented between the two inbound students, with the exception of leveraging norms of the discipline. The two outbound students, Greg (Group C) and Shonyce (Group F) also used a varied set of act types.

Arjuna and Carson both consistently avoided marginality either during on-task (Arjuna) talk or during off-task talk (Carson); both were generally central when that particular talk type was occurring. Additionally, both Carson and Arjuna had flexible

alliances within the group, partnering with different group members at various points in the semester. Finally, despite Carson's centrality generally occurring through off-task talk, both Carson and Arjuna were able to actually participate in their groups' on-task activity. For Arjuna, this typically involved task contributions that were taken up by the group, while for Carson it was through leveraging communication and social skills to position himself as a help seeker and leveraging humor and off-task talk to make nominally relevant contributions.

Greg and Shonyce shared a visibly restricted set of alliances within their groups. Greg partnered with Carson exclusively, who eventually rejected him, and Shonyce partnered primarily with Rania, who did not stay in the group for long. Additionally, Shonyce's other alliances were flimsy and often appeared opportunistic for the more central group member with whom she was partnering (i.e. Paul, Jivan, or Ty). For example, in her brief partnering with Paul and Jivan to ridicule Ty, she sided with two group members in an already-strained relationship with Ty; yet when her and Ty's relationship was tense, neither Paul nor Jivan came to her aid. Another commonality among these two students was their marginality in both on- and off-task periods and low ability to participate during on-task periods. Finally, Shonyce and Greg both were repeatedly seen managing constrained participation by withdrawing from group activity during on-task periods, unlike Carson and Arjuna who found new students with whom to interact and withdrew from off-task activity respectively.

General Discussion

The purpose of this study was to address two questions: (1) How do middle schoolers enact agency in an inquiry science context and (2) how do students' acts of

agency relate to their trajectories of marginality over a semester in inquiry science. The findings indicate seven different acts of agency that students employ in inquiry science when facing marginality that can be divided into two broader types: leveraging resources and managing constrained participation. Further, group members can leverage their groupmates' acts as a justification or logical starting place for their own acts of agency, such as leveraging humor and off-task talk.   Across the semester, the act types used by students mattered less for their trajectories of marginality than two other features: the ability to contribute during on-task episodes and flexible, multiple alliances within their group. Marginal group members lacking the ability to contribute during on-task activity, even if only through nominally on-task commentary, were notably more likely to resort to managing constrained participation by withdrawing from group activity. Those marginal group members whose alliances were restricted to a single group member or were reduced to unequal, exploitative partnerships were also more likely to become more marginal over the semester than were marginal group members who were able to partner with various groupmates as the need arose. These findings raise concerns regarding the importance of context when attempting to understand the efficacy of students' acts of agency for reducing marginality as well as the role of off-task periods in shaping marginality.

The success of marginal group members' acts of agency was first and foremost tied to the context of use rather than the type of act used. While managing constrained participation as a singular act in isolation was overwhelmingly unsuccessful, students who managed constrained participation were represented among both inbound and outbound trajectories across the semester. The same was true for students who leveraged

communication and social skills or humor and off-task talk. What differentiated inbound and outbound students was the flexibility of their alliances in the group and their ability to participate in on-task activity. Though this all may appear intuitive or predictable from a sociocultural standpoint, the implications are somewhat disconcerting when we return our focus to equity goals for students in inquiry science learning contexts. In light of what we know about status problems in groupwork, specifically academic status and peer status, it could become problematic for students with low academic status who cannot find ways to be included in on-task talk and equally problematic for students with low peer status who might have difficulty forming non-exploitative partnerships. For example, Greg and Carson were in the same group, yet had very different outcomes. Carson positioned himself as a help seeker and made nominally on-task contributions by leveraging humor and off-task talk in order to stay in the loop during on-task periods, while Greg was less successful with both of these techniques, partially because Carson abruptly terminated their partnership when it became strategic to do so.

Further complicating the situation with peer and academic status, Shonyce's situation also harkens back to the issue of gender in the status literature: Shonyce was the only girl in the sample to be in a group where she was a visible minority and in light of how sharply her ability to participate changed upon a second girl, Rania, leaving the group it raises questions about whether gender mattered here. Here groupmates Paul, Ty, and Jivan regularly worked together to dismiss her contributions within a competitive group atmosphere and both Ty and Paul used her as a pawn in their own disputes with each other. When Rania was in the group, Shonyce allied with Rania and used this alliance as a powerful foundation for challenging her pairwork partner, Ty, for his hostile

behaviors. For girls in an inquiry science collaboration, other girls in the group may be an important resource for resisting marginality, especially if the number of boys they are friends with in school is low. Poulin and Pedersen (2007) found that early adolescents' same-sex friends typically come from school, while girls' other-sex friends specifically are older and come from outside-of-school sources, suggesting that early adolescent girls may have fewer male friends in their classes. Additionally, girls reported receiving higher levels of help from their same-sex friends.

The findings of this study of middle schoolers' agency in inquiry science collaboration also highlight the importance of attending to off-task periods when studying groupwork, particularly among early adolescents. Findings by Wigfield and colleagues (1991) indicate that students' preference for social activities over the academic domains of English and math increased throughout the seventh grade; this was consistent with students' in the present study having reported during end-of-semester interviews that they enjoyed groupwork specifically because they got to know other students. Wigfield and colleagues' findings also coincide with the present study's finding that leveraging humor and off-task talk was the most frequently used act of agency across all marginal group members. This and prior research all point toward a need to take seriously middle schoolers' interest in socializing when evaluating the effectiveness of inquiry science curricula. For adolescents, peer social support has relevance for their interest in school, engagement in school, and even confidence in critiquing peer work and sharing perspectives (Wang & Eccles, 2012; Garcia-Reid, Reid, & Peterson, 2007). Middle schoolers have also been found to have higher levels of academic efficacy and self-

regulation when they perceive that their teacher encourages classmates to respect their ideas and not to laugh or make fun of them (Ryan & Patrick, 2001).

Implications

We cannot fully understand marginality and agency in inquiry science contexts without honing in on one of the most important domains of early adolescents' lives: the social and emotional world. While high rates of off-task activity may seem like a barrier to be overcome in curriculum development and teacher education regarding collaborative learning, it may be the case that off-task activity is inevitable. More important, the present study demonstrates that off-task activity can actually be a space in which students are able to resist marginality: as in the examples of Carson and Patrick, off-task talk can help students retain a connection to their groupmates in the absence of opportunities to meaningfully contribute to on-task activity and also can help students establish a rapport with groupmates regardless of whether the student is able to make on-task contributions. Off-task talk may also be a coping tool for students during groupwork (McCaslin et al., 2011). The many functions of off-task activity suggest that it is likely unproductive to try to fully eliminate it from groupwork; instead, it may be more appropriate to devise ways to help students use it to establish a positive group climate and support the inclusion of their groupmates.

Students who engage in off-task talk due to inability to contribute in an on-task fashion may need more productive ways to engage their groups. For example, when Greg positioned himself as a help seeker, he was routinely rejected and eventually stopped contributing to on-task activity. This suggests students need a safe environment in which asking a question doesn't yield a blow to one's competence and regard among

peers. A goal of teacher professional development should be to provide teachers with the tools to both recognize unsafe group climates and lay the groundwork for a welcoming group environment in which students can focus on mutual definitions of competence rather than competitive ones (Adams-Wiggins & Rogat, 2013; Darnon et al., 2006). Ironically, in shifting power and authority to students in the classroom, teachers are pressed to find new ways to foster socioemotionally and motivationally supportive environments: when students are given a developmentally-appropriate opportunity to work with peers and gain a degree of autonomy over how they will engage with academic content, students also are given the opportunity to redefine norms of academic activity. These norms of academic activity have the power to impact students' sense of competence, as the norms often include unstated rules about what discourse is appropriate and what means of distributing work are acceptable (Rogat & Adams-Wiggins, 2014).

Thus, an important future direction for research is to examine group norms, sources of those norms, and impact of those norms on students' self-perceptions. By examining groups' norms and where those norms come from, we can better understand the role of whole-class activity and school culture on shaping collaborative groups' functionality. It may be the case that teachers have the power to influence small group activity via classroom culture. Further, the present study is limited by its limited ability to consider the role of membership in a marginalized societal category for marginality in inquiry science. Prior research suggests this is an important route to pursue (Cohen & Lotan, 1994; Carlone et al., 2014). Future research should more systematically address the role of group members' racial identity, gender, and disability status in groupwork.

This study was limited in this respect due to low participation of African-American and Latino/a students in videotaped groups as well as restrictions on information regarding students' learning disabilities.

Limitations

The findings of the present study should be understood with the knowledge of some limitations. First, while the present study's qualitative analysis of marginal identities in inquiry science collaboration extends from Cohen and colleagues' status problems in groupwork research, the present study did not incorporate student ratings of students' academic or peer status and therefore does not directly address status in the same way as Cohen and colleagues work has. Here, observational data and student interviews were the sole sources of information on status hierarchies in students' groups. Thus, status hierarchies here were largely defined in terms of interaction level indicators of status differences. Future studies of marginal identities in groupwork would benefit from the inclusion of peer nomination surveys as a self-report to aid in drawing conclusions about status hierarchies in groups.

Second, the marginality rating system in the present study was in some ways limited in its ability to reflect the nuanced circumstances in which marginality was observed, which required a qualitative analysis and description of marginality trajectories. Specifically, the marginality rating system focused on the observation level, while the analyses here sought to draw conclusions across observations. Thus, marginal rating system scores must be interpreted with caution as they only represent students' marginality in a single observation without consideration of how the observation fits into the overall trajectory. The marginality rating system should not be used as a stand alone

tool for assessing marginality in light of the evidence that group members' marginality

unfolds over time.

References

Adams-Wiggins, K. R., & Rogat, T. K. (2013). Variation in other-regulation and the implications for competence negotiation. *Proceedings of the 10th Computer-Supported Collaborative Learning Conference*, Madison, WI.

Angelillo, C., Rogoff, B., & Chavajay, P. (2007). Examining shared endeavors by abstracting video coding schemes with fidelity to cases. *Video research in the learning sciences*, 189-206.

Barron, B. (2000). Achieving coordination in collaborative problem-solving groups. *The Journal of the Learning Sciences, 9*(4), 403-436.

Barton, A. C., & Tan, E. (2010). We be burnin'! Agency, identity, and science learning. *The Journal of the Learning Sciences*, *19*(2), 187-229.

Basu, S. J., Barton, A. C., Clairmont, N., & Locke, D. (2009). Developing a framework for critical science agency through case study in a conceptual physics context. *Cultural studies of science education*, *4*(2), 345-371.

Baxter Magolda, M. B. (2000). Interpersonal Maturity: Integrating Agency and Communion. *Journal of College Student Development*, *41*(2), 141-56.

Bianchini, J. A. (1997). Where knowledge construction, equity, and context intersect: Student learning of science in small groups. Journal of Research in Science Teaching, *34*(10), 1039-1065.

Carlone, H. B., Scott, C. M., & Lowder, C. (2014). Becoming (less) scientific: A longitudinal study of students' identity work from elementary to middle school science. *Journal of Research in Science Teaching*, *51*(7), 836-869.

Chinn, C. A., & Buckland, L. A. (2011). Differences in epistemic practices among scientists, young earth creationists, intelligent design creationists, and the scientist creationists of Darwin's era. In R. Taylor and M. Ferrari (Eds.), *Epistemology and science education: Understanding the evolution vs. intelligent design controversy* (pp. 38-76). New York:
Taylor & Francis.

Chinn, C. A., Duschl, R. A., & Duncan, R. G., Buckland, L. A., Pluta, W.P. (2008). A microgenetic classroom study of learning to reason scientifically through modeling and argumentation. *Proceedings of the 8th International Conference on International Conference for the Learning Sciences,* Utrecht, Netherlands.

Cobb, P., Gresalfi, M., & Hodge, L. L. (2009). An interpretive scheme for analyzing the identities that students develop in mathematics classrooms. *Journal for Research in Mathematics Education, 40*(1), 40-68.

Cohen, E. G. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research*, *64*(1), 1-35.

Cohen, E. G., & Lotan, R. A. (1997). *Working for equity in heterogeneous classrooms: Sociological theory in practice.* New York, NY: Teachers College Press.

Cornelius, L. L., & Herrenkohl, L. R. (2004). Power in the classroom: How the classroom environment shapes students' relationships with each other and with concepts. *Cognition and Instruction, 22*(4), 467-498.

Darnon, C., Muller, D., Schrager, S. M., Pannuzzo, N., & Butera, F. (2006). Mastery and performance goals predict epistemic and relational conflict regulation. *Journal of Educational Psychology*, *98*(4), 766.

Davies, B., & Harré, R. (1990). Positioning: The discursive production of selves. *Journal for the Theory of Social Behaviour, 20*(1), 43-63.

Davies, B., & Hunt, R. (1994). Classroom competencies and marginal positionings. *British Journal of Sociology of Education, 15*(3), 389-408.

Duncan, R. G., Freidenreich, H. B., Chinn, C. A., & Bausch, A. (2011). Promoting middle-school students' understanding of molecular genetics. *Research in Science Education, 41*, 147-167.

Ellemers, N., & Jetten, J. (2013). The many ways to be marginal in a group. *Personality and Social Psychology Review, 17*(1), 3-21.

Esmonde, I. (2009). Mathematics learning in groups: Analyzing equity in two cooperative activity structures. *The Journal of the Learning Sciences, 18*(2), 247-284.

Garcia-Reid, P. (2007). Examining social capital as a mechanism for improving school engagement among low income Hispanic girls. *Youth & Society*.

González, G., & DeJarnette, A. F. (2012). Agency in a geometry review lesson: A linguistic view on teacher and student division of labor. *Linguistics and Education*, *23*(2), 182-199.

Gresalfi, M., Martin, T., Hand, V., & Greeno, J. (2009). Constructing competence: An analysis of student participation in the activity systems of mathematics classrooms. *Educational Studies in Mathematics, 70*(1), 49-70.

Gutiérrez, K. D., & Rogoff, B. (2003). Cultural ways of learning: Individual traits or repertoires of practice. *Educational Researcher, 32*(5), 19-25.

Hand, V. M. (Mar 2010). The co-construction of opposition in a low-track mathematics classroom. *American Educational Research Journal, 47*(1), 97-132.

Hickey, D. T. (2003). Engaged participation versus marginal nonparticipation: A stridently sociocultural approach to achievement motivation. *The Elementary School Journal, 103*(4), 401-429.

Holland, D., Lachicotte, W. J., Skinner, D., & Cain, C. (1998). *Identity and agency in cultural worlds*. Cambridge, MA: Harvard University Press

hooks, b. (1990). ''Marginality as a Site of Resistance.*'' Out There: Marginalization and Contemporary Cultures*. Eds. R. Ferguson, M. Gever, T. T. Minh-ha, and C. West. Cambridge: MIT, 341-343.

Jackson, P. A., & Seiler, G. (2013). Science identity trajectories of latecomers to science in college. *Journal of Research in Science Teaching*, *50*(7), 826-857.

Kurth, L. A., Anderson, C. W., & Palincsar, A. S. (2002). The case of Carla: Dilemmas of helping all students to understand science. *Science Education, 86*(3), 287-313.

Langer-Osuna, J. M. (2011). How Brianna became bossy and Kofi came out smart: Understanding the trajectories of identity and engagement for two group leaders in a project-based mathematics classroom. *Canadian Journal of Science, Mathematics and Technology Education, 11*(3), 207-225.

Leander, K. M. (2004). "They took out the wrong context": Uses of time-space in the practice of positioning. *Ethos, 32*(2), 188-213.

McCaslin, M., Vega, R. I., Anderson, E. E., Calderon, C. N., & Labistre, A. M. (2011). Navigating and Negotiating in Small-Group Learning. *Sociocultural Theories of Learning and Motivation: Looking Back, Looking Forward*, *10*, 191.

Nasir, N. S., & Hand, V. (2008). From the court to the classroom: Opportunities for engagement, learning, and identity in basketball and classroom mathematics. *The Journal of the Learning Sciences, 17*(2), 143-179.

Penuel, W. R., & Wertsch, J. V. (1995). Vygotsky and identity formation: A sociocultural approach. *Educational psychologist*, *30*(2), 83-92.

Poulin, F., & Pedersen, S. (2007). Developmental changes in gender composition of friendship networks in adolescent girls and boys. *Developmental psychology*, *43*(6), 1484.

Rogat, T.K. & Adams-Wiggins, K.R. (in press). Facilitative versus directive other-regulation in collaborative groups: Implications for socioemotional interactions. *Computers in Human Behavior.*

Rogat, T.K., & Adams-Wiggins, K.R. (2014). Other-regulation in collaborative groups: Implications for regulation quality. *Instructional Science,* 1-26.

Rogat, T. K., Witham, S. A., & Chinn, C. A. (2014). Teachers' autonomy relevant practices within an inquiry-based science curricular context: Extending the range of academically significant autonomy supportive practices. *Teachers College Record*, *116*, 070305.

Ryan, A. M., & Patrick, H. (2001). The classroom social environment and changes in adolescents' motivation and engagement during middle school. *American Educational Research Journal*, *38*(2), 437-460.

Strike, K. A. (2006). The ethics of educational research. In J. L. Green, G. Camilli & P. B. Elmore (Eds.), *Handbook of Complementary Methods in Education Research* (pp. 57-73). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers; US.

Sue, D. W. (Ed.). (2010). *Microaggressions and marginality: Manifestation, dynamics, and impact*. John Wiley & Sons.

Wang, M. T., & Eccles, J. S. (2012). Social support matters: Longitudinal effects of social support on three dimensions of school engagement from middle to high school. *Child development*, *83*(3), 877-895.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York, NY: Cambridge University Press.

Wertsch, J. V. (1998). Mind as action. New York: Oxford University Press.

Wigfield, A., Eccles, J. S., Mac Iver, D., Reuman, D. A., & Midgley, C. (1991). Transitions during early adolescence: Changes in children's domain-specific self-perceptions and general self-esteem across the transition to junior high school. *Developmental Psychology*, *27*(4), 552.

T<small>ABLE</small> 4

Marginality Indicators

Indicator	Description	Example
Deference	Expected or enforced deference to others in a turn order	Patrick is interrupted by Shane; Patrick allows Shane to continue speaking The group regularly waits to allow Donna to give her answers first when sharing answers
Evidence of Low Academic Performance	Getting answers incorrect in presence of groupmates; being recognized by peers as off-task; having one's poor performance in classes discussed by peers	Carson has the teacher read the worksheet to him Greg asks a question that demonstrates his lack of comprehension of the content being covered
Failure to Address Group Member(s)	A group member's idea is unincorporated/unused/ignored; a group member is ignored during group talk	Adam makes a suggestion to the group; the group completely disregards the fact that he made a contribution Carla asks David for his input; Carla proceeds to omit his contributions as the group completes the worksheet together.
Pushed out of Group Talk	Being pushed into exclusion during group talk (both on- and off-task)	Paul talks around Ty as Ty attempts to join off-task talk about Pokemon
Target of Ridicule	Being targeted with putdowns by peers	Greg gets mocked for misunderstanding

		"distantly related" on a worksheet
		Paul and Ty begin discussing Shonyce having bushy eyebrows in front of her
Unequal Access to Tools	Inability to access task tools	Jacob can't see the laptop without crouching on the floor since Arjuna has full control of it
Unequal Evaluation of Peer Work	One-sided expectation of peer evaluation	Shonyce's worksheets are passed among Ty, Paul, and Jivan subjection to evaluation is not mutual

TABLE 5

Marginality Rating System

Rating	Descriptors					Outcome		
	Indicators	Episodes Prolonged and/or Frequent	Salient Resistance to Reintegration	Episodes Consume Observation	Active Attempts to Intensify Marginality	Full Reintegration/No Need for Reintegration	Superficial Reintegration Only	No Reintegration
X – No rating/Member Absent	X	X	X	X	X	X	X	X
0 – Marginality Absent	X	X	X	X	X	√	X	X
1 – Low Marginality	√	X	X	X	X	√	X	X
2 – Low-Moderate Marginality	√	√	X	X	X	√	X	X
3 – Moderate Marginality	√	√	√	X	X	√	X	X
4 – Moderate-High Marginality	√	√	√	X	X	X	√	X
5 – High	√	√	√	√	X	X	√	X
6 - Severe	√	√	√	√	√	X	X	√

Notes: All criteria are applied within an observation for a single student. "Indicators" column represents the presence or absences of marginality indicators for a given student within the observation. "Frequent episodes" refers to an observation in which more than two episodes of a marginality occur for a given student. "Salient resistance to reintegration" refers to groupmates' resistance to reintegrating the marginal group

member during the observation. "Superficial reintegration" is evidenced by a marginal group member nominally being reintegrated (e.g. able to join talk, but marginal group member's suggestions are generally rejected and contributions are not solicited) while "full reintegration" refers to cases where the marginal group member is able is able to rejoin group talk and actively participate (e.g. suggestions are addressed and generally taken up, contributions are solicited). "No reintegration" occurs when a marginal group member is unable to rejoin group talk.

TABLE 6

Acts of Agency: Definitions

Type	Description
Leveraging Communication	Using social and communication skills as a resource by which one can gain access to influence in the group
Leveraging Humor and Off-Task Talk	Using humor as a resource by which one can gain access to influence in the group
Leveraging External Authority	Using the authority of other people and cultural artifacts as a resource by which one can gain access to influence in the group
Leveraging Status Hierarchies	Using status hierarchies as a resource by which one can gain access to influence in the group
Leveraging Norms of the Discipline	Using norms of the discipline (beyond their intended discipline-relevant use) as a resource by which one can gain access to influence in the group
Leveraging Scarce Task Tools	Using the scarcity of a tool or tools to gain access to influence in the group
Managing Constrained Participation	Acts to preserve waning access to influence in the group or manage one's compulsory participation when access to influence is low; ego-focused acts to assert control or competence when evidence of own marginality is present

TABLE 7

Acts of Agency: Frequencies and Success Rates across Groups

Act Type	Frequency	Success Rate
Leveraging Communication/Social Skills	56	53%
Leveraging External Authority	5	60%
Leveraging Humor and Task-Irrelevant Activity	50	60%
Leveraging Norms of the Discipline	0	-
Leveraging Scarce Task Tools	8	50%
Leveraging Status Hierarchies	27	85%
Managing Constrained Participation	42	24%

Note: Success rates are calculated as the total number of successful acts divided by the total number of acts observed; a percentage was then calculated.

TABLE 8

Marginal Group Member Profiles: Acts of Agency, Rates of Success, and Marginality Trajectories

Group Member	Trajectory Type	Overall Success Rate
Arjuna (Group A)	Inbound	63%
Carson (Group C)	Inbound	35%
Greg (Group C)	Outbound	38%
Shonyce (Group F)	Outbound	62%

TABLE 9

Marginal Group Member Profiles: Frequencies for Acts of Agency

Act Type	Arjuna	Carson	Greg	Shonyce
Leveraging Communication/Social Skills	2	4	4	5
Leveraging External Authority	0	1	0	0
Leveraging Humor and Task-Irrelevant Activity	4	14	6	4
Leveraging Norms of the Discipline	0	0	0	0
Leveraging Scarce Task Tools	0	1	0	2
Leveraging Status Hierarchies	0	2	1	5
Managing Constrained Participation	2	4	5	1

Appendix A

Observation Summary

Participation frequencies*:

Group Member	Turns Taken	Percentage of All Turns Taken
Erica	9	17
Necha	12	23
Patrick	9	17
Shane	22	42
Group Total	52	--------

*Turns are defined here as beginning when a student takes the conversational floor and ending when the student voluntarily or involuntarily cedes the floor (either to someone else or to no one specifically) (Adapted from Hogan, Nastasi, & Pressley, 1999). Re-initiation of speaking is used as a signal for the start of a turn when an interruption takes place. This means that interrupted statements in which the speaker stops speaking are divided into separate turns, whereas interrupted statements in which another student talks over only count as a single turn.

Marginal group member(s): Patrick (prolonged)

Task summary: The teacher instructs the group to discuss their answers to questions on worksheets in a packet. The teacher specifically asks Patrick and Erica, and subsequently also Shane, to work together while Necha catches up. When discussing the worksheets, Shane, Patrick, and Erica talk about evidence about genetic resistance.

General summary of group interactions: The group is mostly off-task, even when the group appears nominally on-task. Initially, Shane is engaged in a good bit off off-task talk with a person outside the group as well as Necha. The teacher interrupts the off-task talk and tells Shane, Erica, and Patrick to work together while Necha catches up. Patrick attempts to start discussing the questions, but is interrupted by Shane with nominally on-task talk that is actually just off-task/disruptive activity. Erica engages Shane's nominally on-task statements and Shane proceeds to actually explain his answers (on-task). Patrick tries to jump in twice while Shane is talking and is unsuccessful. He jumps in again while Erica is talking and she stops and he continues giving his answer. Necha then interrupts Patrick with off-task talk. During this off-task talk Patrick's on- and off-task contributions are ignored while the other three talk to each other. Patrick continues attempting to jump into the conversation.

Acts of agency code counts:

Marginal Group Member	Leveraging						Managing Constrained Participation	Other
	Communciation/ Social Skills	*External Authority*	*Humor/Task-Irrelevant Activity*	*Norms of the Discipline*	*Scarce Task Tools*	*Status Hierarchies*		
Patrick	3	0	0	0	0	0	3	0

Responses/outcomes for acts of agency:

Marginal Group Member	Accepted/Taken Up (Successful, 1)	Rejected/Ignored (Unsuccessful, 0)
Patrick	1	5

Summary of acts of agency by marginal group members: Patrick responds to Shane's first interruption by casually saying "Yeah" in a joking tone, thereby joining in on off-task behavior (managing constrained participation). Next, Patrick attempts to jump in again (leveraging communication/social skills), but Shane reclaims the speaking floor. Patrick mutters comments that appear to be a response to Shane's answer, a form of compromise (leveraging communication/social skills). Once Erica claimed the speaking floor, Patrick took the opportunity to jump in (leveraging communication/social skills); this was the only time he was successful in gaining access to participation. Seconds afterward, Necha began to talk over him regarding off-task topics. Patrick continued talking even as her was being talked over (managing constrained participation).

Appendix B

Individual Student Summary (Act Frequencies and Marginality Trajectory Graph Omitted)

Summary of Combinations/Sequences of Acts Used:

On February 26th, Arjuna was marginal for three brief periods. Lauren targeted him for ridicule, calling him weird. He responded by leveraging humor and off-task talk successfully twice toward the end of the observation: once by laughing at Lauren's jokes about him and another time by joining Lauren's off-task discussion. Until the end of the observation he seems fairly oblivious to Lauren's attempts to make a joke of him. Much of his continued participation appears to be a result of his ignoring of Lauren's commentary, although it is unclear whether he is consciously choosing to ignore her; it seems more like he just doesn't get that a joke is even being made. Lauren's push to keep Arjuna marginal was salient in this observation.

In both February 27th observations, Arjuna was not marginal. Further, he actively participated in keeping Lauren marginal by snapping at her verbally and ignoring her at times.

On April 22nd, Arjuna was briefly marginal in two back-to-back instances at the end of the observation. In the first instance he was ignored with his off-task talk. He responded by managing constrained participation. In the second, he was ridiculed for raising his hand a lot in class. He leveraged communication skills to defend himself by saying it was the teacher's fault that he gets called on because he doesn't always raise his hand. It is worth noting that at the beginning of the observation he pushed Jacob into marginality by interrupting Jacob and pushed Lauren into marginality by interrupting her as well.

Analytic Notes:

Arjuna's marginality appears to decrease over the semester. His marginality usually emerges out of ridicule for his lack of social status in the classroom and occasionally his very high academic status. He at times appears oblivious to attempts to position him as marginal. When he is not marginal, he often contributes to his groupmates' marginality by ignoring those who ask questions, talking over them, or monopolizing the task tools. It is as if Arjuna simply doesn't pay attention to how his academic activities can be adapted to be more appropriate to a group activity as opposed to an individual one. Further, it seems like Lauren has hostility toward him and therefore spends a good deal of time

proactively trying to push him into a marginal position through her off-task comments and occasionally her on-task commentary as well.

Appendix C

Semi-Structured Interview Protocol

Interview Protocol - Group Process

1. How does your group go about making decisions and working on a task?
   a. In some groups everyone gets to add to the discussion while in other groups only some group members get to decide. Which is your group more like? Could you give me an example/Tell me more.
   b. Provide an example of a group task students used in the past unit.
2. When group members have different ideas or disagree, how does your group decide which idea to use?
   a. In some groups one group member's ideas are the most often used and in other groups everyone decides. Which is your group more like?
   b. When you disagree, does everyone get a fair chance to have their idea included?
3. Who is influential in your group? How do you know? How do they have influence?
   a. Does everyone have a chance to have influence?
   b. Are the same people influential over time?
   c. Are your contributions heard and taken up/discussed?
   d. What do you do/how do you respond if the group doesn't seem to be including your idea?
4. Are there times when you intentionally wait to say your idea or you choose not to talk?
   a. What reasons do you have for doing that?
5. How comfortable do you feel expressing your views/ideas/opinions in the group? Why?
6. What happens when a group member makes a mistake or is incorrect?
   a. How does the group respond?
   b. Would this be the same for all of your teammates?
7. In what ways, if any, do you benefit from learning with your classmates within your group in science class?
   a. Prompt: What have you learned that you might not learned if you had worked independently?
8. How do you know who has something important to contribute to the group discussion?
9. How much do you think your group learns from the ideas/perspectives you contribute (use participant's language)?
   b. Why do you think this?
10. Do friendships contribute to how well the group works together?
    a. Why do you think this?

Chapter 4: Study 3 - The Role of Group and Classroom Culture in Shaping Marginality in Inquiry Science Collaboration: Activity Systems and Marginal Identity

Recent research from sociocultural perspectives has emphasized the importance of focusing on agency in explaining learning and issues of status in the classroom. In these socioculturally-oriented studies, discussions of low-status group members' experiences often is framed in terms of situations in which they have demonstrated agency in relation to the content. Agency is typically discussed as something emerging from social interactions in which participants share in the co-construction of disciplinary or practice-linked identities (e.g. Basu et al., 2008; Cobb et al., 2009; Gonzalez & DeJarnette, 2012). Yet, conspicuously absent from the discussion is research regarding the exercise of agency in relation to other human actors; the omission means that we have an increasing understanding of students' relationships with disciplines, but our understanding of students' social relationships with each other has been neglected. It is possible that this dearth of research offering accounts of agency in peer and other social interactions is indicative of a challenge in dealing with the research question rather than a lack of interest in the topic: a discussion of agency in peer relationships from a sociocultural perspective requires a simultaneous account of both structure and negotiability in which both the fluidity of identity due to individuals' active negotiation and stability of identity due to social contexts' constraints on the choices of individual actors. On top of all of this, the discussion of structure must avoid already-acknowledged pitfalls in accounts of structure, such as the circular and potentially marginalizing logic of identity essentialism (Magnusson & Marecek, 2010; Tyson et al., 2005) and the

oppressive logic of deficit-thinking (Valencia & Solórzano, 1997, Valencia & Black, 2002).

In discussing agency for a student experiencing marginality, simply describing what group members do in response to acts of exclusion and then suggesting what group members *should* do runs the risk of disregarding the very real power relations that exist for students; consideration must go beyond the immediate context of the group itself. Further, neglecting the role of social structure runs the risk of offering meaningless and ineffective solutions: it would ignore the actual set of options that are available to students in marginal positions and also assume that teachers will otherwise come to the aid of the marginal student. This last assumption is especially dangerous in light of evidence that suggests teachers can contribute to the construction of students' marginal identities through discourse practices and curricular decisions (Boaler, 2008; Hand, 2010; Leander, 2002; Nasir & Hand, 2008; Wortham, 2004). One way to address the challenge of explaining interpersonal agency is to identify ways to capture structure as it is manifested locally by focusing on the role of peer interactions in constructing, reifying, or dismantling marginal identities. The present study aims to contribute to our understanding of agency and marginal identities by honing in on local manifestations of structure within collaborative learning contexts. In the following sections, a review of literature addressing marginal identities in collaborative learning contexts is offered followed by an outline of cultural-historical activity theory as a lens to address this general research question.

Marginal Identities in Collaborative Learning Contexts

Prior research on status problems in the classroom offers insight into the ways social structures constrain agency in small groups. Cohen's research (1972, 1982) highlights the effects of status characteristics that make them a problem: status characteristics by definition involve an expectation of performance (or demonstrated competence) based on a person's relative status. The process of *status generalization* involves the application of expectations for competence to new tasks for which there is no justification for expecting a person's status to be relevant for performance (Berger et al., 1972). Findings suggest that these expectations are associated with differential participation and different levels of influence for students: greater status differences within groups suppress participation for low status group members, high status group members initiate discussion more than low status members, and low status group members perceive themselves as contributing less to the group task, and high status group members' higher rates of on-task talk lead to greater learning (Bianchini, 1997; Cohen, 1972; Lloyd & Cohen, 1999).

Additional research shows that interventions are effective, but Cohen (1982) found that a short-term intervention improving participation of students with low reading status did not ensure changes in status-related expectations of demonstrated competence, which suggests that the expectations that cause status hierarchies are difficult to change and should be handled using more comprehensive approaches. The research also does not assume that expectations must be consciously held; indeed, Cohen (1982) posited that the classroom's task and evaluation structures can exacerbate or alleviate status problems. Specifically, classrooms that promote narrow conceptualizations of ability and enable social comparisons via frequent grading and public evaluation worsen status problems.

Motivation researchers have also noted the adverse effects of social comparison in the classroom, providing widespread support for measures to reduce social comparisons (Ames, 1992; Ryan & Patrick, 2001).

In light of the contributions of the status literature, we are still left with the question of how exactly a group member comes to be understood as occupying a low-status position in the first place before status generalization occurs. It is taken for granted that group members will know who occupies a low-status position, but it is left unclear how students make these identifications. This concern is especially relevant with respect to academic status: findings highlight how competence is socially constructed, with its definition and implications being created in social interaction (Barron, 2003; Engle et al., 2014; Gresalfi et al., 2009; Nolen, 2007). Consistent with the extant literature, Study 1's findings also emphasize that who is "competent" and "incompetent" in the group can have very little to do with who even meets the explicitly and publicly recognized criteria for competence as high-status, influential group members retained control over group regulatory processes even when their intellectual contributions were incorrect.

The findings strongly suggest that high-status does not necessarily derive from a group member actually meeting the stated criteria for membership in the high-status group, such as getting high grades. Instead, something else may happening to signal to group members where each student resides within the status hierarchy. A body of literature is growing that documents the interactions that give rise to marginal identities in the classroom. Some of these studies examine the whole classroom level, while fewer studies discuss its emergence during group work (Boaler & Greeno, 2000; Cobb et al., 2009; Leander, 2004; Kurth et al., 2002; Nasir & Hand, 2008; Nolen, 2007; Rubin, 2007;

Wortham, 2004). Some studies documenting the emergence of marginality in groupwork include studies by Esmonde (2009), Cornelius (2008), and Langer-Osuna (2011).

Studies focusing on groupwork contexts posit marginality as an outcome of various group social processes, which include student authority (Langer-Osuna & Engle, 2010), work practices (Esmonde, 2009), positioning (Langer-Osuna, 2011), relational equity (Boaler, 2008), small group interactions (Barron, 2003; Cornelius & Herrenkohl, 2004; Kurth et al., 2002), and other-regulation (Rogat & Adams-Wiggins, 2014). Nonetheless, as noted in Study 1, findings generally suggest that norms of groupwork may be an important area of study if we seek to capture the ways social structure is woven into local social interactions. In Study 1, students' competence positioning during groupwork was examined by applying Gresalfi and colleagues' (2009) activity theory based lens, *systems of competence*, which framed competence as socially constructed in a classroom-wide activity system. Building on Gresalfi and colleagues' findings, results of Study 1 indicated that students appeared to negotiate competence at the group level in addition to the classroom level. This is highly relevant in light for the present study's goal of identifying the structures within which student agency is enacted: marginal group members are cast as less competent during groupwork, but negotiation of competence at the group level suggests that there are likely also norms constructed at the group level that serve as rules for categorizing group members.

Cultural-Historical Activity Theory as an Analytical Lens

Multiple options exist in terms of socioculturally-oriented frameworks for exploring the role of norms in groupwork. Despite the range of frameworks available, some frameworks' limitations make them inappropriate for the study at hand. It is critical

to note that the different frameworks are not interchangeable and bring different theoretical assumptions (Kirschner & Martin, 2010). For example, more discourse-centered approaches, such as positioning theory, attend to the issue that skills, knowledge, or ability do not always determine individual's contributions to shared endeavors by invoking the distribution of rights and duties to actors via discursive positioning acts that create storylines (Langenhove & Harré, 1999). Positioning theory is concerned with "revealing the explicit and implicit patterns of reasoning that are realized in the ways that people act towards others" and explores the "local moral domain"; further, it is based on the principle that psychology should study meaning-making (Harré et al., 2009, pp. 5-6). Another sociocultural framework, cultural-historical activity theory (CHAT), on the other hand, extends Vygotsky's focus on mediated action in human development to attend to practical activity understood as evolving historically (Cole et al., 1978; Roth & Lee, 2007). Activity theory is concerned with addressing how contributing elements in collective endeavors, including contradictions and transformations, produce consciousness. Further, activity theory treats each individual human's consciousness as a concrete manifestation of the possible consciousness available to humans as a collective whole (Roth, Radford, & LaCroix, 2012).

Williams and colleagues (2007) emphasized that one of the key questions cultural-historical activity theory (CHAT) research should address is the question of how social positioning and power construct personal opportunities and simultaneously act as constraints on and mediators of self-positioning in social interaction. As Fields and Enyedy (2013) explained, the co-construction of identities takes place within the context of culturally sanctioned roles, power relations, and distributions or divisions of labor.

This research direction has already been explored in CHAT analyses focusing on identity (e.g. Roth et al., 2004; Hwang et al., 2005). The present exploration of the role of group norms in constructing of marginal identities serves as an extension of this research direction: an activity systems analysis can help bring to light the aspects of group interaction that come to be normalized and serve to define marginal identities within groups (Barab et al., 2001). Importantly, within activity theory "activity" is understood not as merely being "busy with something", but instead as a system: "a system that contributes to satisfying collective needs as part of the division of labor in society" (Roth & Radford, 2011, p.3). As Roth and Radford (2011) indicated, change is the unit of analysis from a CHAT perspective and the change process itself, rather than difference between two points in time, is the focus because change is presumed to be a constant and continuing process. As a theory, CHAT is oriented toward the issue of agency as it attempts to explain how humans interact with the world to transform it and thereby are themselves transformed. Roth and colleagues (2004) noted that agency is understood as a distinguishing feature of human beings within activity theory, as humans are understood as acting upon their environments to change their material and social worlds.

A key feature of CHAT is its dialectical approach, which evidences the theory's roots in the philosophical works of Karl Marx (Leont'ev, 1978; Engeström & Miettinen, 1999). Roth (2008b) emphasizes the idea of mutual constitution in dialectical relations: for example, the distinction between experts and nonexperts or newcomers and old-timers is less meaningful because they are understood as mutually constituting one another despite being separately identifiable. Instead of being understood as distinct, mutually exclusive pairs, they are instead viewed as "nonidentical expressions of the same

category, which thereby comes to embody an inner contradiction", thus yielding groupings such as individual-collective and agency-structure (Roth, 2007, p. 195). More important, CHAT's use of a dialectical approach to understand the relationship between the individual(s) and the environment leads to an emphasis on *inner contradictions*, which become a focal point in CHAT analyses as they can represent disruptions of activity, explain failures of individual actors to meet their goals (as can be the case when individual goals do not match collective goals), and indicates points for growth in a system (Engeström, 1999; Roth, 2004). The components of activity systems as identified by Engeström (1999) are the subject, mediating artifacts or tools, object of activity, rules, division of labor, and community.

Arguably, the most readily identifiable feature of activity theory to researchers broadly is the set of concepts presented in what Roth (2004) has referred to as the "triangle heuristic", yet this identifier is not without criticism. While the triangle heuristic can help researchers systematically attend to various components within activity systems and help researchers organize their analyses, some have criticized the use of the triangle heuristic for its potential to limit researchers' understandings of CHAT. Roth and Radford (2011) argued that the focus on systemic and structural elements in activity theoretical analyses has limited our understanding of the intrapersonal and interpersonal processes that occur within activity by promoting an emphasis on identifying features of systems rather than exploring how collective and individual consciousness operates within a system. Nonetheless, the research question here directly addresses issues of the intrapersonal and interpersonal, so the present study will use the triangle heuristic purely as an aid for visually modeling activity and organizing research findings.

As stated previously, all components of activity systems are to be understood as in dialectical relations and therefore should be understood as mutually constituted and embodying inner contradictions. *Rules* are the norms and conventions by which individuals (*subjects*) relate to their organizations (*communities*); in an examination of collaborative groups, the groups themselves may serve as the communities. The *division of labor* is a component of activity systems for which the conceptualization evidences the influence of Marx's writings. For Marx, division of labor is understood as taking two forms: the social division of labor (i.e. division of labor in society) in which the means of production is dispersed among many independent producers of commodities and the manufacturing division of labor (i.e. division of labor in the workplace) in which the means of production is concentrated in the hands of a capitalist who has employees (Llorente, 2006; Marx, 1976). Llorente (2006) noted that Marx criticized the manufacturing division of labor as producing human cognitive and psychological impoverishment as well as socioeconomic disempowerment. The manufacturing and social divisions of labor can be also understood as *hierarchical* versus *horizontal* distributions of work respectively and thus this study frames the division of labor as such. In the classroom, a hierarchical division of labor may take the form of a split between intellectual and manual labor (e.g. thinking versus acting as a group scribe) or a split between leaders and followers, both of which cast one party as agentic, independent, and valuable while casting the other party as passive, subordinate, and devalued.

Two sources of recommendations on conducting CHAT analyses are Yamagata-Lynch's (2007) commentary and Holt and Morris' (1993) recommendations. Yamagata-Lynch's (2007) paper on challenges in applying CHAT as a lens for analysis outlined one

approach to conducting CHAT analyses. Yamagata-Lynch diagrammed activity systems, although she acknowledged that the triangle heuristic oversimplified real-world activity; this process involved drafting and re-drafting activity system diagrams, evaluating possible alternative models for activity and using information offered by study participants in interviews and reflections to ensure understanding of their perspectives on activity. Additionally, to capture change, Yamagata-Lynch also had to account for contextual information in each activity system, which could not be incorporated directly into a diagram.

Yamagata-Lynch's (2007) commentary on analytical issues in employing a CHAT framework offers a great deal of guidance with regards to challenges and solutions for researchers. Critically, Yamagata-Lynch (2010) asserts that researchers should openly acknowledge that CHAT analyses require an inherently interpretive and descriptive process which involves presenting the researcher's understanding of the data; thus, the goal of the research is not to make generalizable claims "in the traditional sense" (p. 31). In this way, CHAT analyses benefit from employing what Yin (2003) describes as a *replication logic* as opposed to the *sampling logic*, which produces the traditional generalizable claims Yamagata-Lynch (2010) described. Replication logic focuses on the selection of cases to serve as analogues to multiple experimental replications with the goal of generating theory. Specifically, a replication logic emphasizes being able to generalize to *theory* rather than to populations, which is a key feature of Yin's (2003) case study approach. Further, in order to focus analyses, Yamagata-Lynch (2007) suggested using Rogoff's (1995) distinctions between the three planes of analysis: the intrapersonal, interpersonal, and the collective planes. By focusing on a single plane at a

time, the researcher is able to avoid having unfocused analyses. In this study, the interpersonal plane is the primary analytical focus, while some attention will be given to the collective plane in discussion of classroom-level activity. In the second resource addressing CHAT methods, Holt and Morris (1993) reported a similar strategy to Yamagata-Lynch's in their discussion of employing CHAT for analysis of organizations: the researchers recommended defining the components of the activity system in a diagram, discussing the paradox that gives rise to contradictions, identifying primary contradictions, and demonstrating the emergence of secondary contradictions.

Present Study

The present study aims to understand norms of group interaction that support the construction of marginal identities in light of evidence that competence is negotiated at the group level. The present study addressed the following question:

1. How are activity systems structured in groups where long-term marginality (i.e. marginal identity) emerges?

In order to answer the question, a holistic, descriptive multiple case study methodology was employed. Extending Study 2's analysis of group members' trajectories of marginality over the course of a semester in inquiry science collaboration, a subset three small groups of students from Study 2 constituted the cases under study. Critical to this case study is the curricular context in which activity systems will be examined for all three groups. Features of the PRACCIS curriculum support a shift of authority to students (Cornelius & Herrenkohl, 2004; Rogat, Witham & Chinn, 2014), thus offering increased opportunities for students to engage in discussion and student-student interactions. Yet, previous findings suggest students may engage in practices within the

small group that lead to reduced participation by groupmates, raising the question of whether groups constructed norms that conflict with those intended by curriculum designers and teachers (Rogat & Adams-Wiggins, in press; Adams-Wiggins & Rogat, 2013).

Specifically, if norms within a group differ from those promoted at the whole-class level of instruction, it is likely that groups are functioning as their own activity system with its own contradictions to disrupt activity rather than the group simply being a microcosm of a classroom-wide activity system that endorses the same norms as the teacher promotes in the classroom. Here, it is of interest to consider the way the components of an activity system function and the role overlapping systems play in order to understand why students engage in the unexpected inequitable interactions observed in previous research (Adams-Wiggins & Rogat, 2013; Rogat & Adams-Wiggins, 2014; Rogat & Adams-Wiggins, 2015). Thus, the curriculum in this study provides a rich context for understanding overlapping activity systems in classrooms that heavily involve collaborative learning activities.

Importantly, the study contributes to the literature on marginality by offering a framework that historicizes marginality's social construction by highlighting marginal group members' trajectories of participation as they relate to norms or rules of an activity system and by interrogating the division of labor groups establish in defiance of the expectations of teachers and researchers. The study also contributes by expanding our understanding of agency in the classroom to include the role of students' peers in creating affordances for and constraints on agency during groupwork. In sum, as a means of

understanding how inequity emerges within collaborative groups, the study examines how marginality can be disrupted or normalized in activity.

Method

Case Context

The present case study was conducted in an ethnically-diverse, suburban middle school in the mid-Atlantic United States where teachers were enacting the Promoting Reasoning and Conceptual Change in Science (PRACCIS) curriculum in their seventh grade science classes. Four teachers enacted the curriculum across all of their class periods for a semester. For each of the four teachers, two class periods involved videotaped observations of whole-class instruction, small groupwork, and some pairwork. Two focal groups of four students each were selected for each the videotaped class periods and the focal groups (N = 16 groups) were videotaped for a semester. The PRACCIS curriculum included three inquiry science units which are designed to encourage scientific reasoning, engage students in scientific practices such as evaluating evidence and using evidence to evaluate model fit (Promoting Reasoning and Conceptual Change in Science; PRACCIS; Chinn, et al., 2008; Chinn & Buckland, 2011; Duncan, et al., 2011). The curriculum also sought to develop norms for relying on evidence and providing justification for claims. Students established shared criteria that served as the basis for evaluating model and evidence quality.

Participants were selected for student interviews with the goal of selecting multiple group students from each group. Two of the four members of each of the sixteen videotaped groups were randomly selected and offered the opportunity to participate in an individual student interview. Those students who returned both assent

and consent forms were then interviewed and additional group members were solicited in cases where student refused consent. In one instance, two members of a group had consented, but the remaining two group members were solicited. This was because prior to the inclusion of these two additional students it appeared that no black or African-American videotaped students were included in the interviews. This was done to improve representativeness as well as fairness in the sampling process while still including multiple members of each group represented in the interviews (Strike, 2006).

A total of 26 students were interviewed from a total of 10 different groups; these groups came from all four teachers and from 8 different class periods. Students' demographic information was drawn from the participant data sheets they completed at the beginning of the semester; thus participants' ethnicities are self-identifications. Interviews took place in hallways outside of students' science classrooms and students were permitted to leave class temporarily in order to participate. Two interviewers were present for some interviews, while most were conducted by a single interviewer working alone. In both cases, a single interviewer asked questions from the semi-structured interview protocol while audiorecording the conversation (see Appendix B). When two interviewers were present, the second interviewer listened and made notes regarding body language during rather than after the interview.

Case Selection

Five groups from the larger PRACCIS study were previously examined in Study 2 which addressed middle schoolers' acts of agency and trajectories of marginality in inquiry science collaboration. From that examination, three groups emerged as focal cases for the present study (see Table 10). In an application of replication logic (Yin,

2003), two groups with at least one outbound marginal group member and one group with no outbound marginal group members were selected to test the following case study proposition: groups with a hierarchical division of labor or norms supporting relative notions of competence will have an outbound marginal group member (i.e. evidence of marginal identity).   The three selected groups came from three different class periods and from two different teachers. Selection criteria included: presence or absence of long-term marginal group member, and availability of videotaped observations in which all group members' faces were visible and audio was intelligible. For each group, all videotaped groupwork observations that met these criteria were included in the analyses and a sample of two to three class periods' worth of whole class videotaped observations were included. The three groups had different numbers of valid videorecorded groupwork observations: Group A had 7, Group C had 5, and Group F had 6. Whole class observations came from days for which groupwork had been sampled.

Procedures

The primary sources of data were participant interviews and videotaped observations. The researcher gained familiarity with the school and teachers through spending time on site over the course of the semester. Participants' interviews are a key means by which the researcher gained clarity regarding the meanings students ascribe to processes occurring in the activity systems in which they participate. Yin's (2003) recommendations for enhancing the quality of descriptive multiple case study research designs guided the present study. To establish construct validity in a case study Yin recommends using multiple sources of evidence, establishing the chain of evidence, and having key informants review the case study report. Yin suggests using the *pattern-*

matching technique and addressing rival explanations to support internal validity and using replication logic to build external validity. Finally, Yin insists on the use of a case study protocol and a case study database to ensure reliability. In the present study, key informants were unable to review the case study since they were students moving on after the school year ended.

In the present study, Yamagata-Lynch (2007, 2010) and Holt and Morris' (1993) CHAT methodological recommendations were blended with Yin's (2003) case study approach to address the research question in a two-stage process involving the creation of observation summaries while reviewing videotaped observations in coordination with interview transcripts (See Appendix A). In the first stage, Holt and Morris' first step of discussing the production and consumption paradox was addressed with the goal of capturing how smoothly activity flowed for a group within a given observation. This discussion was then used to guide the identification of primary contradictions. Primary contradictions were identified by examining each component of the activity system individually using all data sources and then after identifying a primary contradiction for each component, secondary contradictions were addressed (see Table 11). For the second phase, viewing activity systems for each group across observations was key.

In the current study observation summaries including an activity system diagram were created for each unit in which each group was observed (see Table 2 for codes and operationalizations). Yamagata-Lynch's (2007) approach was applied by revisiting the data set to examine each group's activity systems across observations to determine whether alternatives to the diagrammed activity systems would better explain activity for each observation of the group. From the diagrams, a set of summary conclusions was

created to characterize each group and rival explanations were considered, in part by comparing and contrasting the two types of groups (i.e. outbound member present and outbound member absent). Finally, pattern matching was applied to draw conclusions regarding the case study proposition that groups with a hierarchical division of labor or norms supporting relative notions of competence would have a long-term marginal group member (i.e. evidence of marginal identity).

Results

The aim of the present study was address the following question: how are activity systems structured in groups where long-term marginality (i.e. marginal identity) emerges? A descriptive, multiple case study was conducted to address the research question. Case study results for three groups will be discussed in this section. First, the structure of activity in the two groups with long-term marginal group members, Groups C and F, will be discussed in detail followed by a discussion of the structure of activity in a comparison group with no long-term marginal group member, Group A. Second, a summary comparing activity systems in groups with an outbound group member and a group without an outbound group member will be provided. Finally, all three groups' activity systems will be discussed in terms of how they contributed to the presence or absence of an outbound member and marginal identities for group members.

The first case involved outbound student Greg's group. Greg was identified in Study 2 as having relied on an alliance with his pairwork partner, Carson, and generally having poor relationships with his other groupmates, Leesha and Luke. Greg frequently leveraged humor and off-task talk unsuccessfully. His alliance with Carson was fairly one-sided and eventually Carson abandoned the partnership to boost his own standing

with Luke and Leesha. By the end of the semester Greg had resorted to managing constrained participation and a strategy of minimally engaged participation. Over the semester, Greg seemed to have difficulty participating in on-task activity even when he was not attempting to distract the group; he also relied heavily on Luke and Leesha for answers along with Carson.

The second case involved the group of outbound member, Shonyce. Shonyce participated most actively when another girl, Rania, was still in her group. Shonyce at times leveraged status hierarchies against Ty. Once Rania left the group, Shonyce's ability to successfully achieve reintegration fell sharply. Shonyce's pairwork partner, Ty, was typically involved in situations where she became marginal. He at times criticized her work and he allied with the other two boys, Paul and Jivan, in the group against Shonyce. Like Greg, Shonyce managed constrained participation later in the semester. Paul often put up barriers to Ty's influence in the group during both on- and off-task periods and Jivan typically joined Paul. Shonyce was more varied in her treatment of Ty.

The third and final case involved Group A in which no group member was outbound. In Group A, Arjuna was often targeted by Lauren for ridicule through off-task talk, although he was very successful during on-task periods. At times, Arjuna ignored Lauren and invited Jacob alone to work with him on group tasks. At other points, Arjuna appropriated group task tools for individual use. Jacob generally had harmonious relationships with both Arjuna and Lauren, but he split his off-task time with Lauren and his on-task time with Arjuna mostly.

Case 1: Group C – Outbound member present - Greg

During the cells unit, Group C's activity was directed toward developing

understanding of the evidence provided (see Figure 1). The group used a shared laptop to

look at video experiment simulation involving potatoes on slides and the group also read

information about Dolly the sheep. The group employed a number of tools in their work

toward understanding, including worksheet packets, videos on slides on a laptop, and

understandings the group developed throughout the unit. Further, the group used

evidence found on slides on the group's laptop as well as teacher support to move activity

forward:

Leesha, Carson, and Luke are seated on one side of the table looking at slides on a

laptop. Greg is away from the group doing catch-up work.

Luke: They implanted this new cell into a wamb of a female sheep.

Leesha: Then they implanted this new cell into a wamb of a female sheep…

Carson: What's a "wamb"?

Leesha: I dunno. (interrupted by Carson's yelling across the room)

Carson: [Teacher 4]! [Teacher 4]! [Teacher 4]!

Leesha: (continues over Carson's yelling) And then the cell developed into a baby

sheep

which was born about 20 minutes late- I'm conf-(Carson interrupts again).

Teacher 4 approaches the group.

Carson: What's a wamb?

Leesha: They said the wamb of the sheep.

Carson: Like the wamb of the sheep.

Teacher 4: The womb (with emphasis).

Leesha: The woo-mb…oh yeah [laughs and points to the teacher].

Teacher 4: Like in the uterus? Like where the babies grow?

Carson: Ohhh.

Teacher 4: So read this carefully. (Teacher 4 leaves group)

Here, teacher support helped the group move past a challenge they faced in using one another tool, which was the evidence slides. Group C's division of labor was horizontal for the most part, as both Leesha and Luke stated during their end of semester interviews. Luke linked the division of labor to an informal rule regarding fairness:

Interviewer: Okay, so my first question for you is how does your group go about making decisions and working on a task?

Luke: So what we do is we go over the information a couple of times, make sure we understand it. Then, as a class, we kind of try – as a group, we try to make a model to see what could be a reasonable model to do and explain to the class of what the model is about.

I: How did you decide to work in the group that way?

M: It just kind of happened because there was nothing really we decided to do. We just knew as a group we have to contribute our ideas or else it wouldn't be fair to some of the other people in our group.

Leesha also reported the view that there was a horizontal division of labor:

Interviewer: So I guess the question I have then, like did you feel like there were roles in the group, like you just mentioned that, you know, you would sometimes let people bounce an idea or whatever.

Leesha: Yeah, I didn't really think so. I think that here were – we kind of like each took turns in a way. Like there were times when a certain person just knew what they wanted to write and they would just share it with the group and we would all kind of go along with it…And there were times like we didn't know what to write. So we just combined all of our ideas together and then we just came up with an answer. But it would mostly be the first one sometimes with the person who like really knows what they're writing.

Leesha stated that there were not strict roles within the group. Nonetheless, primary and secondary contradictions in the rules and division of labor suggested that Luke and Leesha's stated view of the group may have lacked nuance. While the division of labor was the group described was horizontal and the tasks did not require hierarchy, the actual operation of the group involved Luke and Leesha doing a greater portion of work for the group than Carson and Greg; additionally, Carson did not seem to be on board with Luke's stated rule about fairness in sharing the workload seeing as Carson regularly failed to contribute and stayed off-task. In one example, Carson did not seriously engage in a task the group was working on:

Leesha: (reading from slides on laptop) What do you conclude from this
      evidence?

Carson: Well, I conclude that white face sheep are nicer and they have the much
      better nucleus or something? I dunno, we read something about nucleus,
      right?

Leesha: (puts hand on her forehead and sighs) Oh my god…(pauses, then turns
      to Luke) What do you conclude?

Carson: I don't really conclude anything.

Luke: (speaking very slowly) I conclude that the nuc-u-lus controls…how…

Leesha: (looking at Luke) Hey, you stole what I was going to say.

Carson puts a paper on the laptop and Leesha turns to look at him.

Carson: I didn't do anything!

Leesha: Okay, well OBVIOUSLY since the nucleus is the main control

center…main control center thingy, that's why the baby looks

like…(interrupted by Carson)

Carson: You know neither me or Luke is really listening?

Leesha: I don't CARE! Which model… (interrupted by Carson)

Carson: (turning to Luke, laughing) She's just talking and I'm like "what's she

talking about?"

As the episode continued, Carson's lack of contributions to the task expanded to him

fishing for answers from Luke and Leesha:

Carson: Well, I think we're done, so…bye guys. (walks away to the other side of

the table)

Luke: That the nucleus has DNA…DNA changes…(Carson interrupts)

Leesha: So the second one?

Carson: (sarcastic tone) Wait, what are we answering? We didn't even agree on

anything! (returns to where Luke and Leesha are sitting)

Leesha: MAYBE YOU SHOULD PAY ATTENTION!

Carson: Wait, we're not even on this sheet yet?

Leesha: No, we're figuring out which model.

Carson: I've been on the wrong thing the whole time.

Leesha: Which model? I'm going with the second one.

Carson: I'm going with Model B because Leesha's going with it and she told me

she was smart in here.

Leesha: I never said that.

Carson: Wait, where are-what page are we even ON?!

Here, the group's informal rule of expecting group members to know what was going on

also was evident. Leesha criticized Carson saying that he was not focused on the task at

hand and she used this as a justification for not redirecting the group to focus on Carson's

problem. During the genetics unit, Group C's activity took a similar form as they

focused on constructing rules to explain the transmission of traits (see Figure 2). Here,

Group C employed many of the same tools that they had in the cells unit. Teacher

support was employed in this unit, as well, although it was unsolicited. The teacher

approached Group C and asked to see the group's previous work and when the teacher

looked at Carson's work, extensive assistance was offered:

Teacher 4: Let me see some of your answers.

Carson: Okay. I think they're really good.

Teacher 4: Why would you say they're not that good? What makes you think

they're not that good?

Carson: I don't know.

Teacher 4: Alrighty, so what does this say? (points to Carson's worksheet with a

pen)

Carson: (reading as teacher points) It's because both parents have diseases

Teacher 4: So, to answer your question…(reading and pointing) since you know

that, okay, since you now know whether the parents of the father have the

disorder or not, what gene or genes do you think they have?

The teacher continued talking Carson through the questions and repeatedly pushed

Carson to explain his reasoning. The teacher also offered specific feedback to Carson,

telling him his answers were not detailed enough to constitute an explanation. After this

episode of the teacher supporting Carson, though, he was seen off task and walking

around the classroom. Greg was also off-task.

Primary contradictions in the object of activity, rules, division of labor, and

community emerged again during this unit, as did a secondary contradiction between

rules and division of labor. The informal rule of fairness was a problem again as Carson

attempted to directly copy Luke's work and Luke reprimanded him for doing so. Further,

Greg and Carson were both accused by Leesha of not contributing to the group ("I love

how you guys aren't even doing anything yet you're copying"). Even in the face of

Leesha's accusations of slacking, Carson and Greg rationalized copying and continued to

exert no visible effort toward contributing on the task (Carson: "We're supposed to work

as a group"). Also, a primary contradiction in the object of activity was noteworthy in

this unit, as was the case during the cells unit: Greg attempted to reel Luke and Leesha

into off-task talk unsuccessfully and received hostility from Leesha for doing so. Finally,

as is suggested by the other primary contradictions in Group C's activity in the genetics

unit, a primary contradiction within community was evident as Leesha and Luke aligned

with one another to avoid working with Greg and Carson who they viewed as non-

contributors.

Finally, Group C's activity during the evolution unit further exemplified the continuity in the structure of their activities (see Figure 3). During the evolution unit, the group worked on a task where they had to explain the role of amino acids in evolutionary relationships. Unlike the other two units, the group did not attempt to split into pairs for the task in the evolution unit and for the most part functioned as a coherent unit. Nonetheless, primary and secondary contradictions found in the cells and genetics units also appeared here. While the group initially worked jointly to address questions in a worksheet, eventually the group shifted to relying on Luke for answers. Carson asked Luke for an answer without the group as a whole actually having made an effort to answer the question first:

> Carson: Well, I say…(pauses and stares at Luke)
>
> Luke: Oh, okay, now you're going to the Asian, okay.
>
> Carson: Well, why wouldn't I? (Leesha snaps fingers at Luke)
>
> Luke: I'm reading.
>
> Carson: Wait, did you say something Luke? You're definitely right. Just, just, you're right.

Leesha joined in on pressing Luke for answers, snapping her fingers at him, to which he responded by saying "I'm reading". This constituted a change from the cells and genetics units in that the informal rule of fairness in contributions was violated even by Leesha who was among those insisting on a shared workload. Additionally, the contradiction within the object of activity was the same as the prior two units, yet less a matter of a divided group. In the previous two units, Carson and Greg almost exclusively spent time

entertaining themselves and trying to entertain the group, but during the evolution unit all four group members shifted into heavy off-task activity.

Case 2: Group F – Outbound member present - Shonyce

During the cells unit, Group F consisted of Shonyce, Ty, Jivan, and Rania. Group F's activity in the cells unit focused on evaluating quality of evidence and competing in a quiz game as a form of review (see Figure 4). Like Group C, Group F had primary contradictions within the object of activity, although theirs was more a tension between demonstrating competence to the others or winning and focusing on everyone achieving understanding.

> Ty: OH! (waves hands vigorously requesting the group's answer sheet from Shonyce) Give it back!
>
> Jivan: What is it?
>
> J grabs the paper and pen, but is interrupted by the teacher.
>
> Teacher 3: [J], if you're going to write, then you need to sit there.
>
> J gives the paper back to Shonyce.
>
> Ty: Nucleolus.
>
> Shonyce takes the paper and turns to write.
>
> Ty: Please don't get this wrong. Please don't spell this…(trails off)
>
> Teacher passes by indicating the Group F's answer is correct.
>
> Shonyce: The one with the "o". Nucle-OLUS! (pointing to a student in another group)
>
> Ty: (looking at Shonyce) Told you…

In the episode here, Group F participated in a quiz game and competed against other groups in the class. The teacher walked around the classroom to check groups' answers, which each group had written on a paper. Ty quickly gave answers in the group and on few occasions did Jivan or Shonyce disagree with him. As in the example above, a mild primary contradiction within the object of activity was visible: during this review game the group was required to work quickly in order to win, leaving little time to explain ideas when group members did not understand. Further, primary and secondary contradictions within the rules and division of labor were present and involved Ty positioning himself as a leader within the group. First, Ty positioned himself as an intellectual leader, offering correction to Jivan:

Ty: Uh, it doesn't talk about the nucleus a lot, so you can conclude it's probably not good evidence…you know, what [Teacher 3] said.

Jivan: The tadpole? It doesn't conclude…

Ty: You know what? It's actually, eh, the fourth website is not good evidence, it's not good, it's not good evidence, but it does support the control model. The control center. It supports it, but it's not good. You can't trust it, but it does connect to it somehow. It's not irrelevant.

Jivan: I thought it was.

Ty: No, but…she explained it, but you can't trust it.

Jivan: Yeah, you can't trust it because you don't even know who she is.

Ty: But the evidence supports (interrupted by Jivan)

Jivan: It does. It does. Yeah.

Ty: Yeah. So we're not gonna look at that as much. (pauses)

In general, when Ty offered intellectual leadership in the cells unit, he discussed with his groupmates the reasons behind his disagreements with their conclusions and his group was receptive. Immediately following this episode, though, Ty took a more directive tone, rather than simply guiding his groupmates when their ideas required revision. Ty was not successful at all in attempting to direct the group here:

> Rania and Shonyce engage in brief inaudible off-task talk.
>
> Ty: (to Jivan) No scrolling. No, not you. Fine, you can scroll. (pauses) [Shonyce], you're not doing anything.
>
> Rania: Is this right?
>
> Shonyce: Let me see.
>
> Ty: Don't copy.

J's approach here was not well-received and his accusations of cheating elicited tones of annoyance from Rania and Shonyce. Nonetheless, Ty reported in an end-of-semester interview that he felt his groupmates saw him as a leader:

> I: Okay. So, how did you get your groupmates to consider your ideas?
>
> Ty: They usually consider my ideas anyway because, uh, I know a lot about science but occasionally I get things wrong and try really to not see me as the perfect image. [I: Okay, interesting.] Because like, I know it's not like a perfect world, and I'm pretty sure the other members of my group like think that way. [I: Okay] And I believe they have better answers than me most of the times.
>
> I: Okay, interesting. Okay, so how, umm, so I guess…first, how do you know that they see you that way?

T: Well, they usually ask me for answers and see me like, talk to me like as the leader [I: Ohh-kay.] and I don't feel like being leader because I don't feel like I'm the best though.

During the genetics unit, Rania was replaced by Paul in the group. Group F worked toward revising their answers in a worksheet packet about HIV. Primary and secondary contradictions were more salient during the genetics unit than during the cells unit. As the group worked on evaluating evidence and all group members were off-task throughout and repeatedly had to bring themselves back to the task. During a task that involved the group using a shared laptop, roles were fluid: group members shared the use of the task tools and made decisions about next steps as a group. They also took a less competitive tone and spent more time joking. Group F's activity also evidenced a primary contradiction within the object of activity: group members appeared to struggle with focusing on the task itself rather than asserting individual correctness or achievement. Jivan and Shonyce ended up in an off-task conversation about grades and Ty joined:

Jivan: Did you do your math homework?

Shonyce: Yeah.

Jivan: I'm so happy. I got an 81 in math.

Shonyce: Final grade?

Jivan: Yeah.

Shonyce: I got an 89 (smiles).

Jivan: Really? (Shonyce nods) I'm not good at math. It's my worst subject.

Shonyce: I'm good at math. I'm like, very good.

Ty: I'm in algebra (with emphasis, leans in toward Shonyce)

Shonyce: Don't rub it in!

The conversation re-emerged after a brief stint of on-task talk:

Jivan: I can't believe I got a 95.

Shonyce: On what? Oh yeah, your presentation.

Jivan: And I got a 92 for my essay.

Shonyce: I got 80. For PowerPoint. I didn't turn in my essay. I probably got a

zero for that.

Jivan: A 0%? That's terrible.

Shonyce: I KNOW (stares at Jivan with eyes wide open). It wouldn't be the first

time.

Jivan: Shouldn't you be crying?

Shonyce: I don't cry.

Jivan: Are you gonna tell your parents?

Shonyce: No.

Jivan: Why?

Shonyce: Because they'll say it sucks and sue (gestures with hand).

Ty: What did you get for math?

Shonyce: Math? I have an 89.

Ty: I have a NINETY-TWO! (gesturing with both hands)

Shonyce: Don't rub it in.

Ty: I'M IN ALGEBRA, TOO! (gesturing with both hands)

Jivan: I have a 90. Eat it. Eat my 90.

This primary contradiction did not prevent the group from achieving its end goal as the group had an extended period to complete the task. Yet, another primary contradiction within rules was more disruptive to group activity. Paul, Ty, and Jivan all spent time evaluating Shonyce's work, and there was no reciprocity.

During the group's final unit on evolution, Group F identified similarities between models, evaluated evidence, and revised answers in a worksheet about HIV (see Figure 6). Again, primary contradictions were present, this time in the object of activity, community, and division of labor. The first and most salient primary contradiction was in the object of activity and was evidenced by Paul, Jivan, and Ty's tone in discussing answers:

Ty: They have both types of genes.

Paul: There's both types of genes…

Ty: There's both, there's both…

Paul: Does it say that in here? (pauses) No, umm, there's two, ummm…two

like…(interrupted by Jivan)

Jivan (interrupting Paul): Wait, doesn't the population vary in that one?

Paul: Yeah.

Ty: (interrupting Paul) TWO (interrupted by Jivan)

Jivan: (interrupting Ty) So population varies.

Ty: That's what I said! (with emphasis)

Paul: You were talking about genes and stuff like that (laughs)

When Jivan said the population varied, Ty insisted that he had already said this before and thus Jivan was offering no original ideas. Ty's emphasis on having had ideas before

his groupmates was a recurring theme for Group F. Ty also regularly took a condescending tone to explain how his groupmates were incorrect, especially Paul. Here, Paul and Jivan then explained this by saying that Ty was not talking about the same thing. Finally, Ty mocked Jivan for a previous incorrect answer he gave. This kind of competitive tone continued between Jivan, Ty, and Paul later after the two joked about Pokémon during off-task talk. Paul and Jivan worked to emphasize the incorrectness of Ty's idea:

> Ty: No.
>
> Paul: Yeah, it says "most of the head size"….
>
> Ty: Not always
>
> Paul: Yes it does. These two models.
>
> Jivan: Yeah
>
> Paul: We're talking about these [J]. (laughs)Start doing the right
>
> packet….write…….
>
> Jivan: Yeah. Yeah, [J] (shakes head with emphasis)

J continued to raise the stakes for Paul's incorrect answers by taking sarcastic, mocking, and competitive tone by asking Paul how a species ended up in a particular location if Paul's logic were to be taken seriously. Paul responded with a joke saying that the species swam to the location. The second and third primary contradictions were in the community and division of labor. The contradiction within the community was evident in the group's wavering between on and off-task activity. Ty repeatedly attempted to keep Paul in an off-task conversation about Pokémon and later attempted to join a conversation between Paul, Jivan, and Shonyce about basketball. Ty and Paul's

dominance of on-task activity represented the contradiction within the division of labor in which Jivan and especially Shonyce often took a passive role watching Ty and Paul go back and forth in disagreement.

Case 3: Group A – No outbound member present

Group A consisted of three members: Lauren, Jacob, and Arjuna. Group A was in one of Teacher 4's classes, although in a different class period than Group C. Group A was in a class period described by Teacher 4 as a well-behaved class, specifically in comparison to the teacher's second videotaped class period, to which Group C belonged. Across the semester, a point of tension for the group was the question of whether the group had a leader. The issue of leadership arose in student interviews as well as observations of groupwork. Jacob described the group as having a shared workload, but suggested that Lauren was less talkative when asked whether everyone had similar influence in the group:

> Interviewer: How does your group go about making decisions and working on a task?
>
> Jacob: We usually try to split up the work and we don't just copy the answer when we're done. We make sure that we go over it and understand because we know the teacher's going to check it and she's going to make sure that we know all of it anyway. So you can't even get away with cheating anyway if we tried.
>
> I: Okay. How do you decide about splitting up the work?
>
> J: We don't do it in sides. We make sure everyone has equal parts, like everyone has equal work. We don't make everyone have the easier job. If we have trouble, we work in it together.

Further, Jacob explained that a single group member, Arjuna, had ideas that were used more often within the group:

> I: In some groups, one group member's ideas are the most often used. In other groups, everyone decides. Which was your group more like?

J: One person's ideas are used.

I: Okay, and can you tell me more about that member and how you decided to use their idea?

J: He's smart. He's the other one being interviewed. He's good at persuading you, depending on what the idea is. Sometimes we don't like his ideas and we just do our own thing. But sometimes he has good reasons and we change our model.

Additionally, with regards to Arjuna, Jacob specified that "we usually fight a lot but he's not a bad kid…he's nice and he's smart so he's – and he's probably really influential".

Arjuna's perspective echoed Jacob's in that he did not specify the existence of a leader, yet unlike Jacob he described things in a way that cast himself engaging in leader-like actions:

Interviewer: All right. So, the first question I have for you is how does your group go about making decisions and working on a task?

Arjuna: Well, they do listen to and if they get off track, I guess I kind of tell them to do their work.

I: Okay. So then since you mentioned like you would tell them to do their work, do people have specific roles in the group then?

A: Not really. I guess sometimes we just split up the work. So then we do – so we split up the work and we do our parts and we like share answers.

I: Okay, and so like was there any leader at all?

A: Not really. Well, I don't know. They always look to me for answers I guess. I don't know.

Although both Arjuna and Jacob described the group as splitting work equally and having no strict roles, both described their group as if there was some conflict between the ideal

of splitting work equally without a leader and the reality of how the group operated. This conflict was real and visible during observations of Group A, appearing as a recurring contributor to primary contradictions for the group. Across observations of Group A, tensions arose regarding the issue of leadership and the focus of group activity. Figure 7 depicts the structure of activity in Group A during observations the first unit of the semester, which covered cells.

The primary contradiction within the division of labor was the most salient throughout the cells unit for Group A. During one task, Group A was required to use a summary evidence sheet to create their own models individually and then discuss what was needed in the model and why. Group members took on roles that were similar to one another: Lauren, Jacob, and Arjuna worked individually, solicited feedback from each other, and expressed points of confusion to one another. Nonetheless, the primary contradiction within the division of labor was visible during the task as Lauren solicited Jacob and Arjuna's feedback, Jacob solicited Arjuna's feedback, but no one solicited Lauren's feedback. Further, Arjuna solicited feedback from neither of his groupmates. While the division of labor was superficially horizontal, Arjuna still acted as a leader who offered input into Lauren and Jacob's individual actions yet was not himself subject to others' input.

Similarly, the primary contradiction manifested in Group A's use of the laptop computer as a task tool. Arjuna was the sole operator of the laptop across observations and operated the tool in a highly-individualized manner: he placed the computer directly in front of himself, out of the line of sight of both Jacob and Lauren. This required Jacob to crouch on the floor in order to access the information on the laptop. Lauren also

directly addressed the issue saying "Arjuna, we're supposed to do it as a group". Further, a contradiction in the object of activity was salient in the cells unit: the group regularly wavered between on- and off-task activities, such as when Lauren and Arjuna talked about tadpoles in the worksheets looking like "baby aliens" even as Jacob attempted to continue with the task itself. Finally, a contradiction was also present in the community during the cells unit. The group's somewhat weak cohesion was evident in Arjuna's frequent individualization of group tasks (e.g. his use of the group's laptop) and Jacob and Lauren's occasional attempts to push Arjuna into marginality. In one instance, Lauren and Jacob worked together to blame Arjuna for the group being video recorded and called on by the teacher frequently. Arjuna countered the accusations successfully and was reintegrated in the group. At other times, Arjuna was less successful in sustaining insider status in the group, such as when Lauren personally attacked him while they looked at evidence about Dolly the sheep. Lauren continued to mock Arjuna throughout the task until the end of the class period and repeatedly stated that something was wrong with Arjuna and used the word "disgusting" repeatedly. Arjuna pushed back against Lauren's comments by explaining away things for which Lauren had mocked him (e.g. "I don't really like One Direction", "That isn't disgusting…I wasn't staring at it. I need to get the information to do good in it").

Group A continued to evidence contradictions within the object of activity in the genetics unit and the contradiction manifested in ways that were similar to what occurred during the cells unit (see Figure 8). There were two primary contradictions in the object of activity that pressured the group away from collaborative work. Unlike the cells unit, the object of activity was the only locus of a primary contradiction and the contradictions

within the object of activity were far more pronounced than they had been in the cells

unit. Across observations in the genetics unit, Group A often spun into off-task talk,

which was typically led by Lauren:

> Arjuna: I chose C.

> Lauren: I didn't say anything.

> Arjuna: Like all the groups, (Lauren interrupts) if one person has it, if the
> offspring has it, then one of the parents has it and…

> Lauren: (interrupting Arjuna) Hahaha, I like how he has X's in his eyes.
> (Pointing to worksheet with pencil) Dead. You guys are all dead.
> (interrupted by Jacob)

> Jacob: (interrupting Lauren) In number 4, they all have it.

> Arjuna: Yeah. That's…(interrupted by Lauren)

> Lauren: (continues interrupting Arjuna, pointing to worksheet with pencil) Dead.
> Dead! Dead! Dead! Dead!

> Arjuna: If you were dead, you would have a circle.

> Lauren: No. You'd have an X on your eyes.

> Arjuna: No, not technically.

> Lauren: Yes, technically!

> Jacob: If you're dead you should look like (gestures with his face, squeezing his
> eyelids shut with his fingers)

> Lauren: Yeah, they look like that. Ehhhhhh.

> Jacob: Their eyes aren't closed. They're just sewed shut.

> Lauren: So they're dead.

The off-task discussion above continued until Lauren abruptly began reading questions from the worksheet. Jacob and Arjuna quickly joined her on-task actions. Group A's off-task episodes were often long, nominally related to the task, and contested by at least one of the group members. Nonetheless, it appeared that Group A successfully completed the tasks assigned to them.

Summary of Activity in Groups

In summary, the three groups examined here had activity structures that were largely consistent across units during the semester. Group C was defined by contradictions in the rules and division of labor involving issues of fairness in the workload for each group member. Group C's Carson and Greg regularly were off task and relied on Leesha and Luke to do the bulk of the intellectual work. Additionally, Leesha at times demonstrated a reliance on Luke for answers. Further, Group C faced challenges due to a contradiction in the tools in which the tools were being used by Greg and Carson to craft legitimacy for their failure to contribute and also used tools to re-negotiate their own workload within the group. Similarly, Group F was defined by contradictions in the division of labor and the object of activity. Themes of activity in Group F included leadership disputes and a high salience of competence: Ty and all other group members regularly clashed over his attempts to position himself as a managerial leader of the group and repeatedly discussion of competence. Group F spent both on- and off-task time discussing competence by bringing up grades, reminding each other of past mistakes, and taking an adversarial or dismissive tone to address disagreements over ideas. Finally, Group A was characterized by its contradictions in the community, division of labor, and object of activity. Group A often appeared to be unfocused with

regards to the object of activity and spent a great deal of time in superficially on-task talk that then turned into fully off-task discussion. Further, Group A had disputes about the structure of tasks, as Arjuna consistently individualized tasks.

Activity Systems and the Marginal Identities

The main goal of this study was to explore activity's bearing on marginal identities in across a semester of inquiry science units, specifically with regards to group norms. Group A did not have a long-term marginal group member, while Groups C and F did: Greg and Shonyce respectively. Some commonalities emerged for the three groups discussed here with regards to the structure of activity. First, all three groups evidenced primary contradictions, as was to be expected. From an activity theoretical standpoint, contradictions are ubiquitous and are not unique to dysfunctional groups engaged in activity. Second, all three groups evidenced a mostly horizontal division of labor despite being in different class periods with different teachers. Further, all three groups evidenced contradictions within the division of labor. Finally, all three groups evidenced contradictions within the object of activity, albeit in differing forms. Thus, it appears that contradictions, rules, or the division of labor in and of themselves were not sufficient to produce long-term marginality and emergence of a marginal identity for group members.

Among the two groups with long-term marginal group members, Groups C and F, a key similarity distinguishing them from Group A was contradictions within rules for both groups. In both Group C and Group F, there was some level of disagreement among group members regarding rules. For Group C, the disagreement consistently revolved around issues of fairness in contributions to work and these disagreements also were

reflected in the division of labor for the group across units. Group C's Carson and Greg both regularly failed to contribute to the group's work and even at times explicitly stated that they expected other group members to do the intellectual work, as was the case when Carson on two different occasions asked Luke and Leesha for answers. The tension around the group's rules was high and at one point exploded into a harsh exchange between Greg and Leesha in which Leesha took Greg's worksheets to check whether he had written any answers on his own and then offered the statement that "[Greg's] answers are too awful for me". Similarly, contradictions in the rules for Group F were linked to the division of labor. Ty of Group F repeatedly positioned himself as a leader in the group and faced resistance from the group as they were being relegated to passive roles in decision making, evidenced in the contradiction of an intellectual labor/manual labor distinction in the division of labor. Additionally, Shonyce was subjected to peer evaluation that her groupmates did not experience, which again placed her in a subordinate position within the group.

In Groups C and F, the contradictions within the rules and division of labor were interconnected in that the rules enabled a hierarchical division of labor to emerge when both groups reported a horizontal division of labor as what they thought the group should or did have. In Group C, Carson and Greg were at odds with Luke and Leesha as the two pairs of students strove to control the rules of how the group would operate and in turn how the division of labor would be defined for the group. This dispute involved the positioning of Greg as a slacker and non-contributor; by invoking rules regarding fairness, Leesha was able to justify rejecting Greg as a work partner. Carson avoided the outcome Greg faced by positioning himself as in need of help and therefore not in

violation of norms dictating that group members should contribute equally. In Group F, Ty pushed to position himself as a leader and to also thereby define the division of labor as hierarchical, placing himself in a managerial role. In invoking a hierarchical division of labor with a split between intellectual and manual work, Shonyce also ended up regularly in low-status positions, such as acting as a scribe during a quiz game and having her work disproportionately subjected to scrutiny. While all three groups demonstrated disagreements between group members' conceptions of how the group should operate, only Groups C and F involved a defining set of contradictions in which the rules and division of labor jointly could promote conditions for marginal identities to be constructed for Greg and Shonyce.

Discussion

The purpose of the present study was to address the question of how activity systems are structured in groups where long-term marginality (i.e. marginal identity) emerges. The results run counter to the initial proposition of the case study: hierarchical division of labor and rules favoring hierarchy were not associated with the presence of marginal identities in groups here, yet division of labor and rules as components of activity systems were the means by which outbound members' marginal identities could be constructed. In groups with outbound members present, group members used rules of the group to justify exclusion or disparaging of a groupmate. Further, group members enacted exclusion by restructuring the division of labor by either redefining it such that not all group members interacted with one another (Greg of Group C) or by reifying the low position of a groupmate by building their low position directly into the division of labor (Shonyce of Group F).

The findings here highlight the importance of attending to peer social interactions in when attempting to understand students' identities in the classroom. While studies of disciplinary and practice-linked identity afford description of the moment-to-moment interactions in which students form relationships with science or mathematics, the present study findings suggest that less explicitly disciplinary aspects of group interactions may come to bear on students' disciplinary identities. First, if students end up in marginal positions within their groups and their marginal positions are solidified through group norms and distribution of work, this is likely to discourage them from further engaging the content. Second, if group members are able to successfully reconfigure group activity such that a hierarchical distribution of work and a hierarchies of competence emerge, even students who pursue deeper relationships with the discipline may find their pursuit abruptly halted by the actions of classmates. Importantly, students with marginal identities may find it increasingly difficult to successfully exercise agency when their own groupmates actively contribute to group culture of exclusion.

A question is raised by the results of this study: why do group members engage in actions that appear to directly marginalize their peers? Students here did not report disliking their groupmates in end-of-semester interviews and students exhibited an idealization of egalitarian group norms. Additionally, the curricular context involved tasks that did not require the kinds of hierarchies that group members often promoted, either intentionally or unintentionally. As extant research addressing student achievement motivation has emphasized, competence is an important motivator for students; school, classroom, and broader cultures can promote competitive notions of competence, in which competence is defined relative to that of others, as if it were some

sort of scarce commodity. That is, relative definitions of competence presume the impossibility of mutual competence and pit students against one another. This sense of competition has already been highlighted in other research as particularly problematic in collaboration (Darnon et al., 2006; Midgley et al., 2006). Thus, future research should aim to better integrate prior work on achievement motivation, particularly competence, into explanations of sociocultural phenomena. Further, future research examining school-level peer culture may also prove fruitful in characterizing students' agency in a socioculturally-appropriate manner.

Implications

For teachers seeking to employ inquiry and collaborative learning techniques in their classrooms and for researchers seeking to promote inquiry and collaboration, many challenges are expected in the process, but hostile and marginality-promoting interactions among students are not at the top of the list. Nonetheless, the present study demonstrated that with increased student agency, students' interpersonal interactions deserve attention beyond their import for cognitive processes in learning. In order to reap the benefits of inquiry learning environments and collaborative learning contexts, we must develop ways to help teachers and students create safe groupwork environments in which experiences of marginality do not push students away from engagement with science content and toward stressful experiences of having to prove one's own worth in school among peers. The literature on early adolescents' achievement motivation strongly suggests that teachers should carefully consider whether messages of competition are present in their classrooms, even at the group level. Simply avoiding statements about relative competence is unlikely to be enough in the context of a Western country in which

competition, hierarchy, and marginalization are widely accepted and encouraged practices. Teachers may need to actively push students' toward viewing each other as partners in the learning process and build in incentives for students to collaborate rather than compete. This is in stark contrast to the messages sent by the increasing emphasis on standardized testing with normative evaluations of students' ability and the competitive process of college admissions awaiting adolescents in high school. By leveraging strengths of early adolescents themselves, such as a desire to feel a sense of belonging and a desire to feel competent, inquiry and collaboration can become powerful tools for enhancing student's learning and fostering positive identities in school.

Limitations

The findings of the present should be interpreted in light of limitations due to the scope of the analyses. The study did not address tertiary contradictions and the role of overlapping activity systems in explaining trajectories of marginality. From an activity theory perspective, multiple systems of activity overlap and contradictions can emerge between systems. In the present study, other relevant systems that could have been examined include activity systems at the classroom-level and school-level activity systems. First, classroom-level activity systems may explain why group members reported egalitarian norms despite employing a hierarchical division of labor. Second, school-level activity systems were also likely to be relevant: end-of-semester student interviews suggested that students and teachers viewed high achievement and high academic aspirations as normative and low achievement and low academic aspirations as deviant. Additionally, the limited number of groups with no outbound member restricted the number of cases that could be included in the study. Thus, the present study theorizes

about the function of group activity in constraining individuals' agency in inquiry science collaboration contexts, yet further research is needed to assess the conditions under which the findings are replicable.

References

Adams-Wiggins, K. R., & Rogat, T. K. (2013). Variation in other-regulation and the implications for competence negotiation. *Proceedings of the 10th Computer-Supported Collaborative Learning Conference*, Madison, WI.

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84*(3), 261-271.

Angelillo, C., Rogoff, B., & Chavajay, P. (2007). Examining shared endeavors by abstracting video coding schemes with fidelity to cases. *Video research in the learning sciences*, 189-206.

Barab, S. A., Barnett, M., Yamagata-Lynch, L., Squire, K., & Keating, T. (2002). Using activity theory to understand the systemic tensions characterizing a technology-rich introductory astronomy course. *Mind, Culture, and Activity*, *9*(2), 76-107.

Barab, S. A., Evans, M. A., & Baek, E. (2004). Activity theory as a lens for characterizing the participatory unit. In D. Jonassen (Ed.), *Handbook of Research on Educational Communications and Technology* (2nd ed., pp. 199-213). Mahwah, NJ: Lawrence Erlbaum Associates.

Barron, B. (2003). When smart groups fail. *The Journal of the Learning Sciences*, *12*(3), 307-359.

Barton, A. C., & Tan, E. (2010). We be burnin'! Agency, identity, and science learning. *The Journal of the Learning Sciences*, *19*(2), 187-229.

Basu, S. J., Barton, A. C., Clairmont, N., & Locke, D. (2009). Developing a framework for critical science agency through case study in a conceptual physics context. *Cultural studies of science education*, *4*(2), 345-371.

Baxter Magolda, M. B. (2000). Interpersonal Maturity: Integrating Agency and Communion. *Journal of College Student Development*, *41*(2), 141-56.

Berger, J., Cohen, B. P., & Zelditch, M. (1972). Status characteristics and social interaction. American Sociological Review, *37*(3), 241-255.

Bianchini, J. A. (1997). Where knowledge construction, equity, and context intersect: Student learning of science in small groups. Journal of Research in Science Teaching, *34*(10), 1039-1065.

Boaler, J. (2008). Promoting 'relational equity' and high mathematics achievement through an innovative mixed-ability approach. British Educational Research Journal, *34*(2), 167-194.

Boaler, J*., & Greeno, J.G. (*2000*).* Identity, agency, and knowing in mathematics worlds*. In* J. Boaler *(Ed.), Multiple perspectives on mathematics teaching and learning, (pp.* 171-200*).* Westport, CT*:* Ablex.

Carlone, H. B., Scott, C. M., & Lowder, C. (2014). Becoming (less) scientific: A longitudinal study of students' identity work from elementary to middle school science. *Journal of Research in Science Teaching*, *51*(7), 836-869.

Chinn, C. A., & Buckland, L. A. (2011). Differences in epistemic practices among scientists, young earth creationists, intelligent design creationists, and the scientist creationists of Darwin's era. In R. Taylor and M. Ferrari (Eds.), *Epistemology and science education: Understanding the evolution vs. intelligent design controversy* (pp. 38-76). New York: Taylor & Francis.

Chinn, C. A., Duschl, R. A., & Duncan, R. G., Buckland, L. A., Pluta, W.P. (2008). A microgenetic classroom study of learning to reason scientifically through modeling and argumentation. *Proceedings of the 8th International Conference on International Conference for the Learning Sciences,* Utrecht, Netherlands.

Cobb, P., Gresalfi, M., & Hodge, L. L. (2009). An interpretive scheme for analyzing the identities that students develop in mathematics classrooms. *Journal for Research in Mathematics Education, 40*(1), 40-68.

Cohen, E. G. (1972). Interracial interaction disability. *Human Relations, 25*(1), 9-24.

Cohen, E. G. (1982). Expectation states and interracial interaction in school settings. *Annual Review of Sociology*, *8*, 209-235.

Cohen, E. G. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research*, *64*(1), 1-35.

Cohen, E. G., & Lotan, R. A. (1997). *Working for equity in heterogeneous classrooms: Sociological theory in practice.* New York, NY: Teachers College Press.

Cole, M., John-Steiner, V., Scribner, S., & Souberman, E. (1978). *L.S. Vygotsky: Mind in society, the development of higher psychological processes*. Cambridge, MA: Harvard University Press

Cornelius, L. L. (2008). Student participation in disciplinary discourses: When the teacher takes a step back, who takes a step forward?. *Proceedings of the 8th International Conference on International Conference for the Learning Sciences,* Utrecht, Netherlands.

Cornelius, L. L., & Herrenkohl, L. R. (2004). Power in the classroom: How the classroom environment shapes students' relationships with each other and with concepts. *Cognition and Instruction, 22*(4), 467-498.

Darnon, C., Muller, D., Schrager, S. M., Pannuzzo, N., & Butera, F. (2006). Mastery and performance goals predict epistemic and relational conflict regulation. *Journal of Educational Psychology*, *98*(4), 766.

Davies, B., & Harré, R. (1990). Positioning: The discursive production of selves. *Journal for the Theory of Social Behaviour, 20*(1), 43-63.

Duncan, R. G., Freidenreich, H. B., Chinn, C. A., & Bausch, A. (2011). Promoting middle-school students' understanding of molecular genetics. *Research in Science Education, 41*, 147-167.

Ellemers, N., & Jetten, J. (2013). The many ways to be marginal in a group. *Personality and Social Psychology Review, 17*(1), 3-21.

Engeström, Y. (1999). Activity theory and individual and social transformation. In Y.

Engeström, R. Miettinen & R. Punamaki (Eds.), *Perspectives on activity theory* (pp. 19-38). USA: Cambridge University Press.

Engeström, Y. (2007). From communities of practice to mycorrhizae. In J. Hughes, N. Jewson & L. Unwin (Eds.), *Communities of Practice: Critical Perspectives* (pp. 41-54). London: Routledge.

Engeström, Y., & Miettinen, R. (1999). Introduction. In Y. Engeström, R. Miettinen & R. Punamaki (Eds.), *Perspectives on activity theory* (pp. 1-18). USA: Cambridge University Press.

Engestrom, Y. (2009). The future of activity theory: A rough draft. In A. Sannino, H. Daniels & K. D. Gutierrez (Eds.), *Learning and Expanding with Activity Theory* (pp. 303-328). New York, NY: Cambridge University Press.

Esmonde, I. (2009). Mathematics learning in groups: Analyzing equity in two cooperative activity structures. *The Journal of the Learning Sciences, 18*(2), 247-284.

Fields, D., & Enyedy, N. (2013). Picking up the mantle of "expert": Assigned roles, assertion of identity, and peer recognition within a programming class.*Mind, Culture, and Activity*, *20*(2), 113-131.

Garcia-Reid, P. (2007). Examining social capital as a mechanism for improving school engagement among low income Hispanic girls. *Youth & Society*.

González, G., & DeJarnette, A. F. (2012). Agency in a geometry review lesson: A linguistic view on teacher and student division of labor. *Linguistics and Education*, *23*(2), 182-199.

Gresalfi, M., Martin, T., Hand, V., & Greeno, J. (2009). Constructing competence: An analysis of student participation in the activity systems of mathematics classrooms. *Educational Studies in Mathematics, 70*(1), 49-70.

González, G., & DeJarnette, A. F. (2012). Agency in a geometry review lesson: A linguistic view on teacher and student division of labor. *Linguistics and Education*, *23*(2), 182-199.

Gutiérrez, K. D., & Rogoff, B. (2003). Cultural ways of learning: Individual traits or repertoires of practice. *Educational Researcher, 32*(5), 19-25.

Hand, V. M. (Mar 2010). The co-construction of opposition in a low-track mathematics classroom. *American Educational Research Journal, 47*(1), 97-132.

Hickey, D. T. (2003). Engaged participation versus marginal nonparticipation: A stridently sociocultural approach to achievement motivation. *The Elementary School Journal, 103*(4), 401-429.

Holland, D., Lachicotte, W. J., Skinner, D., & Cain, C. (1998). *Identity and agency in cultural worlds*. Cambridge, MA: Harvard University Press.

Holt, G. R., & Morris, A. W. (1993). Activity theory and the analysis of organizations. *Human Organization*, *52*(1), 97-109.

hooks, b. (1990). ''Marginality as a Site of Resistance.*'' Out There: Marginalization and Contemporary Cultures*. Eds. R. Ferguson, M. Gever, T. T. Minh-ha, and C. West. Cambridge: MIT, 341-343.

Hwang, S., Roth, W., & Pozzer-Ardenghi, L. (2005). Understanding collaborative practice: Reading between the lines actions. *Outlines: Critical Social Studies, 7*(1), 50-69.

Jackson, P. A., & Seiler, G. (2013). Science identity trajectories of latecomers to science in college. *Journal of Research in Science Teaching*, *50*(7), 826-857.

Kirschner, S. R., & Martin, J. (2010). The sociocultural turn in psychology: An introduction and an invitation. In S. R. Kirschner & J. Martin (Eds.), *The sociocultural turn in psychology: The contextual emergence of mind and self* (pp. 1-27). New York, NY, US: Columbia University Press.

Kurth, L. A., Anderson, C. W., & Palincsar, A. S. (2002). The case of Carla: Dilemmas of helping all students to understand science. *Science Education, 86*(3), 287-313.

Harré, R., & Van Lagenhove, L. (1999). Positioning theory: Moral contexts of international action. Malden, MA: Blackwell Publishers

Langer-Osuna, J. M. (2011). How Brianna became bossy and Kofi came out smart: Understanding the trajectories of identity and engagement for two group leaders in a project-based mathematics classroom. *Canadian Journal of Science, Mathematics and Technology Education, 11*(3), 207-225.

Leander, K. M. (2002). Locating Latanya: The situated production of identity artifacts in classroom interaction". *Research in the Teaching of English*, *37*, 198-250.

Leander, K. M. (2004). "They took out the wrong context": Uses of time-space in the practice of positioning. *Ethos, 32*(2), 188-213.

Leont'ev, A. N. (1978). *Activity, consciousness, and personality*. (M. J. Hall, Trans.). Englewood Cliffs, NJ: Prentice Hall.

Llorente, R. (2006). Analytical Marxism and the division of labor. *Science & Society*, 232-251.

Lloyd, P., & Cohen, E. G. (1999). Peer status in the middle school: A natural treatment for unequal participation. *Social Psychology of Education, 3*(3), 193-214.

Magnusson, E., & Marecek, J. (2010). Sociocultural means to feminist ends: Discursive and constructionist psychologies of gender. In S.R. Kirschner, & J. Martin (Eds.), *The sociocultural turn in psychology: The contextual emergence of mind and self* (pp. 88-110). New York, NY, US: Columbia University Press.

Marx, K. (1976). Capital, vol. 1. *Trans. Ben Fowkes. London: Penguin/New Left Review*.

Nasir, N. S., & Hand, V. (2008). From the court to the classroom: Opportunities for engagement, learning, and identity in basketball and classroom mathematics. *The Journal of the Learning Sciences, 17*(2), 143-179.

Nolen, S. B. (2007). Young children's motivation to read and write: Development in social contexts. *Cognition and Instruction, 25*(2-3), 219-270.

Penuel, W. R., & Wertsch, J. V. (1995). Vygotsky and identity formation: A sociocultural approach. *Educational psychologist*, *30*(2), 83-92.

Poulin, F., & Pedersen, S. (2007). Developmental changes in gender composition of friendship networks in adolescent girls and boys. *Developmental psychology*, *43*(6), 1484.

Rogat, T.K. & Adams-Wiggins, K.R. (in press). Facilitative versus directive other-regulation in collaborative groups: Implications for socioemotional interactions. *Computers in Human Behavior.*

Rogat, T.K., & Adams-Wiggins, K.R. (2014). Other-regulation in collaborative groups: Implications for regulation quality. *Instructional Science,* 1-26.

Rogat, T. K., Witham, S. A., & Chinn, C. A. (2014). Teachers' autonomy relevant practices within an inquiry-based science curricular context: Extending the range of academically significant autonomy supportive practices. *Teachers College Record*, *116*, 070305.

Rogoff, B. (2008). Observing sociocultural activity on three planes: Participatory appropriation, guided participation, and apprenticeship. *Pedagogy and practice: Culture and identities*, 58-74.

Roth, W.M. (2004). Activity theory and education: An introduction. *Mind, Culture, and Activity, 11*(1), 1-8.

Roth, W.M. (2007). Emotion at work: A contribution to third-generation cultural-historical activity theory. *Mind, Culture, and Activity, 14*(1-2), 40-63.

Roth, W.M. (2008). Realizing Marx's ontology of difference. *Mind, Culture, and Activity, 15*(2), 87-92.

Roth, W.M., & Lee, Y. (2007). "Vygotsky's neglected legacy": Cultural-historical activity theory. *Review of Educational Research, 77*(2), 186-232.

Roth, W. M., & Radford, L. (2011). *A cultural-historical perspective on mathematics teaching and learning* (Vol. 2). Springer Science & Business Media.

Roth, W. M., Radford, L., & LaCroix, L. (2012, May). Working with cultural-historical activity theory. In *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, *13*(2).

Roth, W.M., Tobin, K., Elmesky, R., Carambo, C., McKnight, Y., & Beers, J. (2004). Re/making identities in the praxis of urban schooling: A cultural historical perspective. *Mind, Culture, and Activity, 11*(1), 48-69.

Roth, W.M. (2009). On the inclusion of emotions, identity, and ethico-moral dimensions of actions. In A. Sannino, H. Daniels & K. D. Gutierrez (Eds.), *Learning and Expanding with Activity Theory* (pp. 53-71). New York, NY: Cambridge University Press.

Rubin, B. C. (2007). Learner identity amid figured worlds: Constructing (in) competence at an urban high school. *The Urban Review, 39*(2), 217-249.

Ryan, A. M., & Patrick, H. (2001). The classroom social environment and changes in

adolescents' motivation and engagement during middle school. *American Educational Research Journal*, *38*(2), 437-460.

Strike, K. A. (2006). The ethics of educational research. In J. L. Green, G. Camilli & P. B. Elmore (Eds.), *Handbook of Complementary Methods in Education Research* (pp. 57-73). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers; US.

Sue, D. W. (Ed.). (2010). *Microaggressions and marginality: Manifestation, dynamics, and impact*. John Wiley & Sons.

Tyson, K., Darity, W., & Castellino, D. R. (2005). It's not "a black thing": Understanding the burden of acting white and other dilemmas of high achievement. *American Sociological Review, 70*(4), 582-605.

Valencia, R. R. & Solorzano, D.G. (Eds.). (1997). *The evolution of deficit thinking: Educational thought and practice.* Bristol, PA: The Falmer Press.

Valencia, R. R., & Black, M. S. (2002). "Mexican Americans don't value education!"— On the basis of the myth, mythmaking, and debunking. *Journal of Latinos and Education, 1*(2), 81-103.

Wang, M. T., & Eccles, J. S. (2012). Social support matters: Longitudinal effects of social support on three dimensions of school engagement from middle to high school. *Child development*, *83*(3), 877-895.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York, NY: Cambridge University Press.
Wertsch, J. V. (1998). Mind as action. New York: Oxford University Press.

Wigfield, A., Eccles, J. S., Mac Iver, D., Reuman, D. A., & Midgley, C. (1991). Transitions during early adolescence: Changes in children's domain-specific self-perceptions and general self-esteem across the transition to junior high school. *Developmental Psychology*, *27*(4), 552.

Wortham, S. (2004). From good student to outcast: The emergence of a classroom identity. *Ethos, 32*(2), 164-187.

Yamagata-Lynch, L. C. (2007). Confronting analytical dilemmas for understanding complex human interactions in design-based research from a cultural—historical activity theory (CHAT) framework. *The Journal of the Learning Sciences*, *16*(4), 451-484.

Yamagata-Lynch, L. C. (2010). *Activity systems analysis methods: Understanding complex learning environments*. Springer Science & Business Media.

Yin, R. (2003). *Case study research: Design and methods*. Sage.

TABLE 10

Participants

Group & Description		Group Members	Teacher	Class Period
A	Outbound Member Absent	Lauren[2], Jacob, Arjuna	Teacher 4 (Female)	7/8
C	Outbound Member Present (Greg)	Carson[2], Leesha, Greg[2], Luke	Teacher 4 (Female)	4/5
F	Outbound Member Present (Shonyce)	Shonyce, Ty, Paul[1], Jivan, Rania[1,2]	Teacher 3 (Male)	5/6

1: Group F initially included Shonyce, Ty, Jivan, and Rania. Rania was later switched out of the group and Paul replaced her.

2: Group member was not interviewed at the end of the semester.

TABLE 11

Codes and Operationalizations

Code	Definition	Examples
Subject	The actor(s) within an activity system	Group members
Mediating Artifacts	Psychological or material tools used by subjects to transform object/outward goals into a concrete outcome	Laptop, set of curricular norms, teacher support
Object	The outward goal, concrete purpose, or objectified motive of activity; could be raw materials, conceptual understandings, or even problem spaces	Completing a worksheet, planning a project, demonstrate competence
Rules	Norms and conventions by which subjects relate to their communities; can be formal (systematic, general, expected), informal (idiosyncratic adaptation), and technical (mandated, potentially written)	Sharing the work equally is most fair, take turns stating ideas
Community	Individuals who share the same division of labor	Collaborative group
Division of Labor	Organization of processes related to the goal; runs horizontally (distributed across community members with equal status) or vertically (tasks distributed up and down divisions of power)	Leaders and followers, group members equally share roles and rotate tasks, workers and social loafers
Primary Contradiction	A contradiction within one of the entities of the activity system, such as rules	Each individual should know the task requirements but it is unfair to not help a classmate who does not understand (contradiction within rules)
Secondary Contradiction	A contradiction between entities in an activity system, such as rules and object	Sharing the work equally is most fair but designating a leader is quick (contradiction between rules and object)

FIGURE 1

Group C's Activity across Cells Unit

Figure 1. Activity system structure for Group C's activity during observations of the cells unit.

F<small>IGURE</small> 2

Group C's Activity across Genetics Unit

Tools: Worksheet packets, discussion, teacher support, outside knowledge, understandings developed throughout the unit

Subject: Group C

Object: Construct rules to explain passage of traits;

Primary Contradiction: Learn together vs. entertain the group

Outcome: Completed worksheet questions

Rules: Pay attention to the task, each individual should know the task requirements and necessary background knowledge, all must contribute or it is not fair

Primary Contradiction: Contributing fair share vs. social loafing

Community: Collaborative Group

Primary Contradiction: Group vs. two pairs

Division of Labor: Mostly horizontal

Primary Contradiction: Matt and/or Chelsey as sole active members vs. equal roles within group

Secondary Contradictions:

1. Rules and Division of Labor: split work equally versus active and passive group members

Figure 2. Activity system structure for Group C's activity during observations of the genetics unit.

FIGURE 3

Group C's Activity across Evolution Unit

Tools: Worksheet packets, discussion, outside knowledge, understandings developed throughout the unit

Subject: Group C

Object: Explain role of amino acids in evolutionary relationships → Outcome: Completed worksheet questions

Primary Contradiction: Learn together vs. entertain the group

Community: Collaborative Group

Division of Labor: Mostly horizontal

Primary Contradiction: Matt as source of answers vs. equal roles within group

Rules: Pay attention to the task, each individual should know the task requirements and necessary background knowledge, all must contribute or it is not fair

Primary Contradiction: Contributing fair share vs. social loafing

Secondary Contradictions:

1. Rules and Division of Labor: split work equally versus Matt as source of answers

Figure 3. Activity system structure for Group C's activity during observations of the evolution unit.
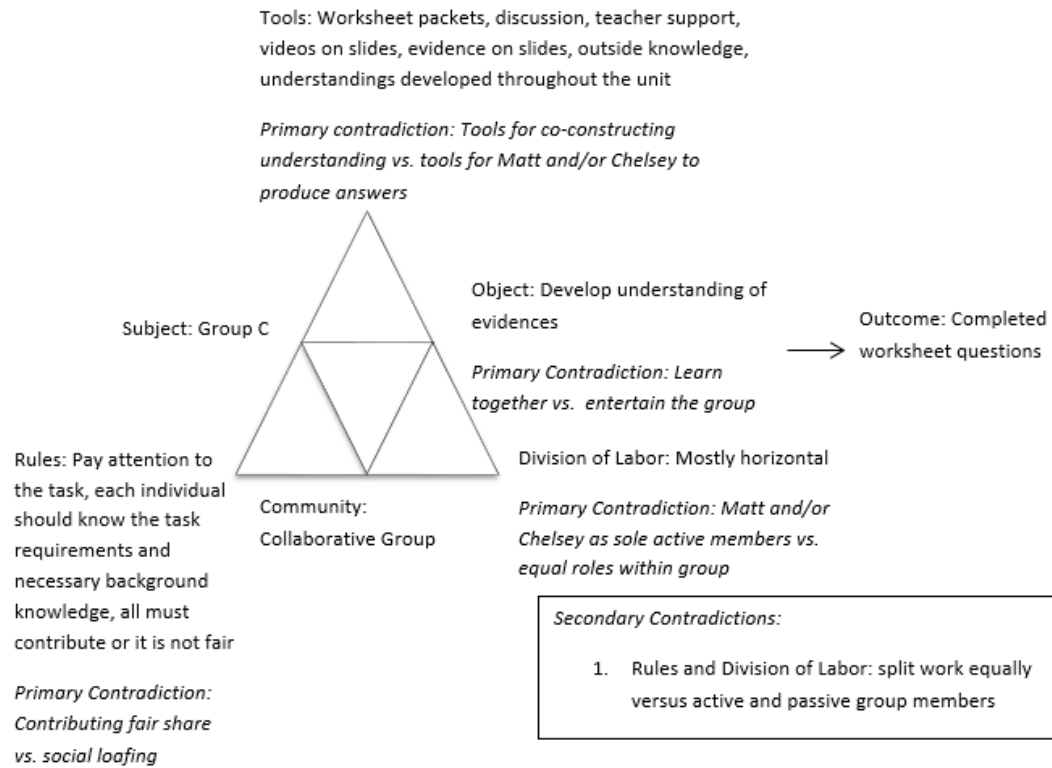
FIGURE 4

Group F's Activity across Cells Unit

Figure 4. Activity system structure for Group F's activity during observations of the cells unit.

Figure 5

Group F's Activity across Genetics Unit

Tools: Worksheet packets, understandings developed throughout the unit, discussion within group, norms for evaluating evidence

Subject: Group F

Object: Evaluate evidence; revise individual answers in worksheet about HIV

Primary Contradiction: Achieve shared understanding vs. assert individual correctness

Outcome: Completed worksheet questions; improved understanding

Rules: Take turns stating answers/ reading, justify disagreements with evidence

Community: Collaborative Group

Division of Labor: Mostly horizontal

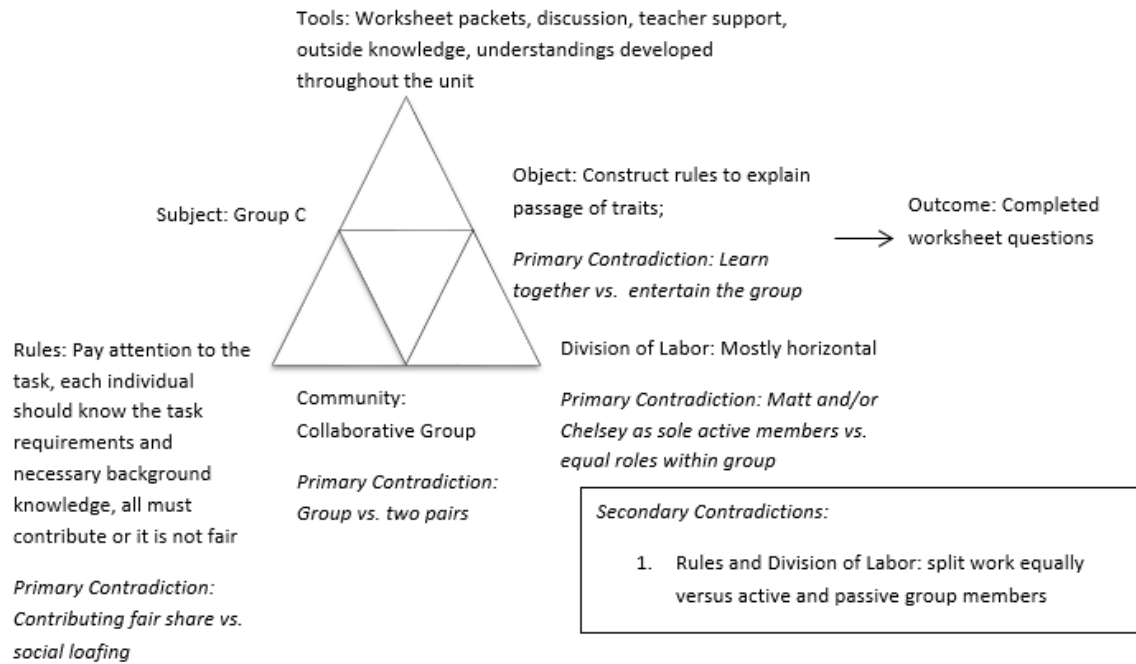*Primary Contradiction: Equal expectation of peer evaluation vs. disproportionate evaluation of Bene's work*

Figure 5. Activity system structure for Group F's activity during observations of the genetics unit.
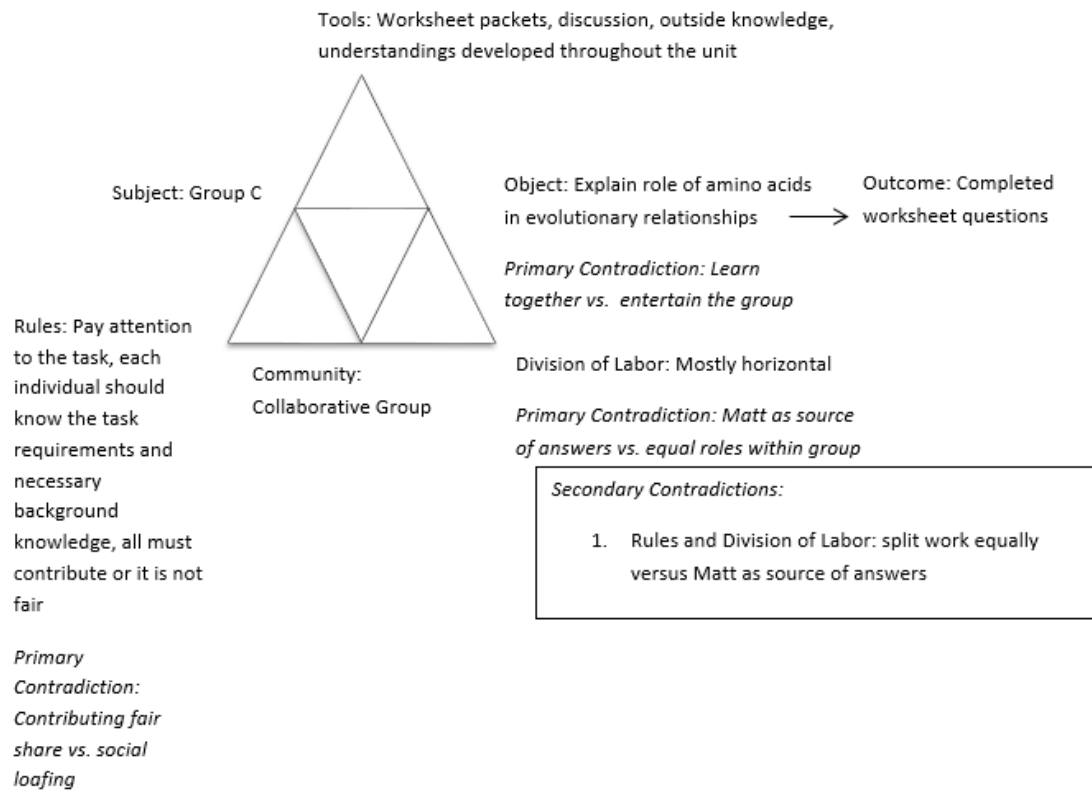
FIGURE 6

Group F's Activity across Evolution Unit

Tools: Worksheet packets, understandings developed throughout the unit, discussion within group, norms for evaluating evidence

Subject: Group F

Object: Rate evidence quality; Identify similarities between models

Primary Contradictions: Achieve shared understanding vs. assert individual correctness

Outcome: Completed worksheet questions; improved understanding

Rules: Take turns stating answers/ reading, Joseph reads questions and referees discussion

Community: Collaborative Group

Primary Contradiction: On-task group vs. socializers

Division of Labor: Mostly horizontal

Primary Contradiction: equal roles within group vs. intellectual labor and manual labor divisions

Secondary Contradiction:

Object and Community: Thoroughly address ideas vs. expeditiously complete task

Figure 6. Activity system structure for Group F's activity during observations of the evolution unit.
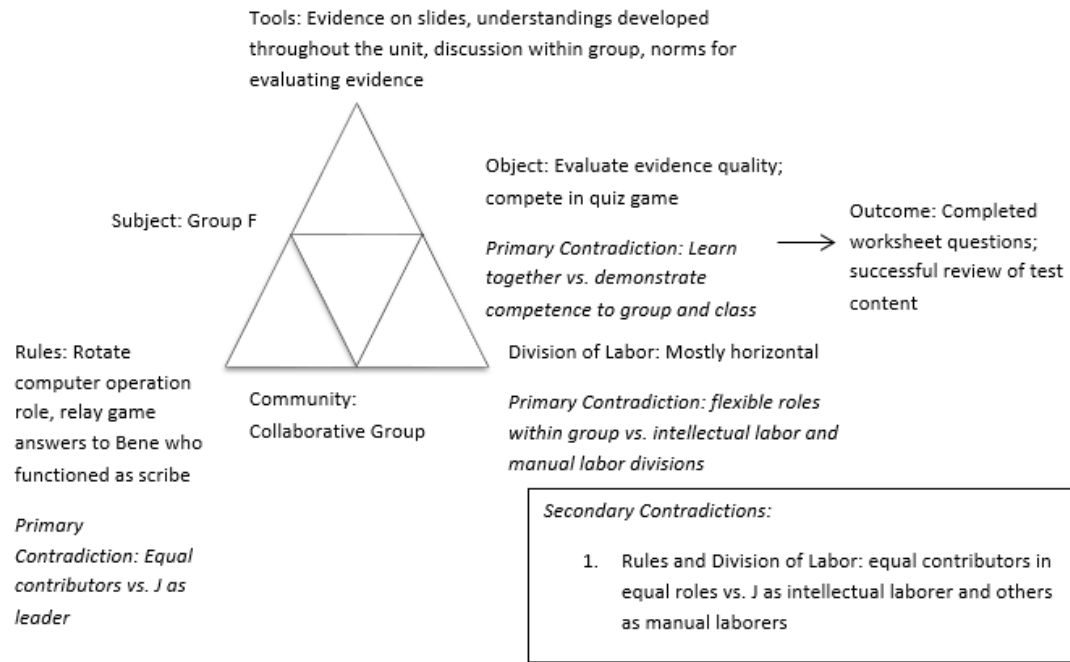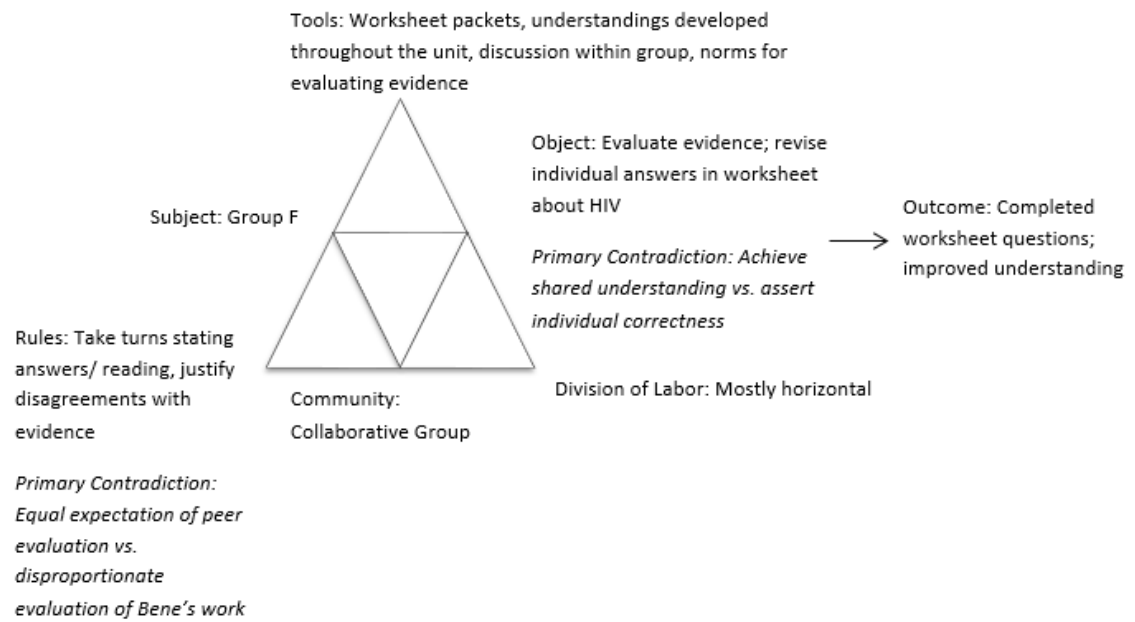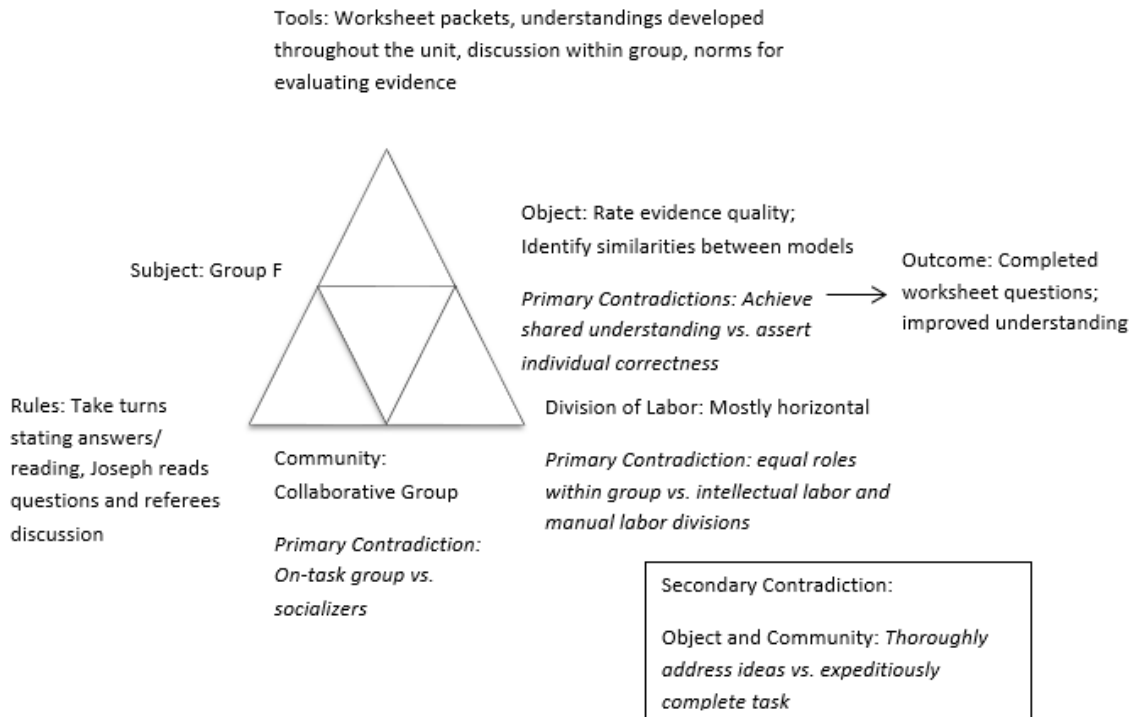
FIGURE 7

Group A's Activity across Cells

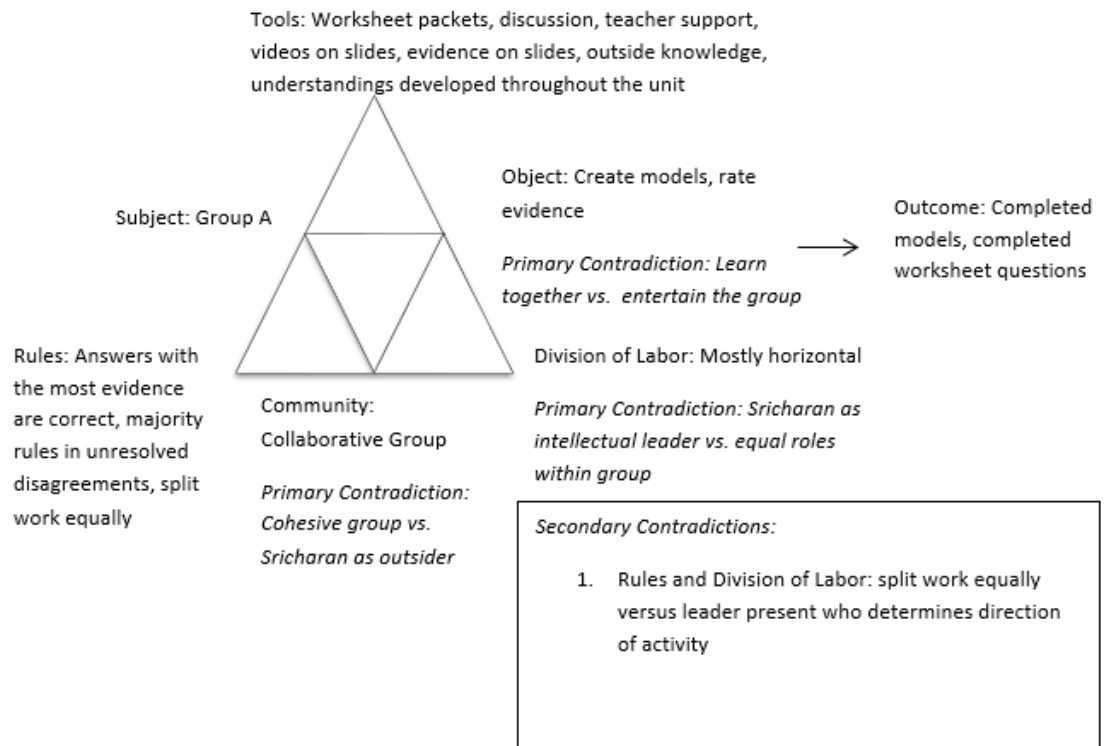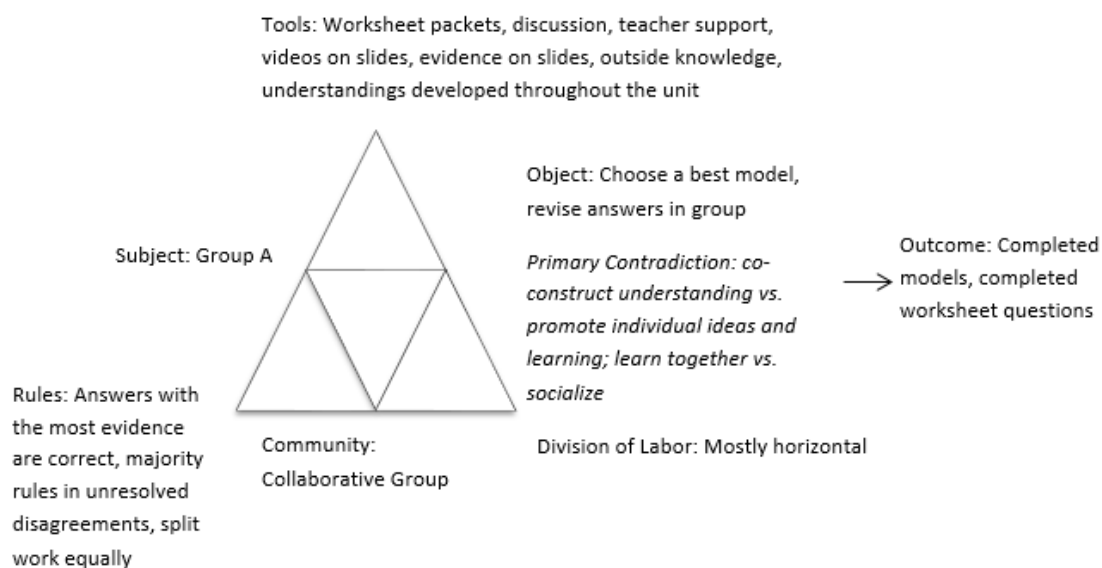*Figure 7.* Activity system structure for Group A's activity during observations of the cells unit.

Group A's Activity across Genetics

Tools: Worksheet packets, discussion, teacher support, videos on slides, evidence on slides, outside knowledge, understandings developed throughout the unit

Subject: Group A

Object: Choose a best model, revise answers in group

Primary Contradiction: co-construct understanding vs. promote individual ideas and learning; learn together vs. socialize

Outcome: Completed models, completed worksheet questions

Rules: Answers with the most evidence are correct, majority rules in unresolved disagreements, split work equally

Community: Collaborative Group

Division of Labor: Mostly horizontal

Figure 8. Activity system structure for Group A's activity during observations of the genetics unit.

Appendix A

Observation Summary Example

Within each section, evidence from the videotaped observation (groupwork, whole class, pairwork) should be included to contribute to a coherent picture of the structure of each group as an activity system.

Object & Outcome: The group is participating in a competitive quiz game hosted by the teacher as a form of review about cell organelles (object). Improved understanding and winning the game are the products (outcome/product).

Subject: Students (Shonyce, Ty, Jivan)

Community: The community here is the collaborative group. The group largely operates autonomously with minimal input from the teacher. Thus, the group's norms and division of labor are shared and distinct from that of other groups in the classroom.

Division of Labor: Shonyce functioned as the group's scribe while Ty stated most of the group's answers to her. Jivan also made comments regarding the group's answers, but less often than Ty. The division of labor is hierarchical, split between intellectual and manual labor forms. In end-of-semester interviews contradicted: Jivan said "It was pretty much equal", Ty said that the group viewed him as a leader.

Rules: A rule functioning in the group was that answers would be relayed to Shonyce. The group also worked as quickly as possible since the game was competitive. Ty told Shonyce not to say the answers out loud twice.

Mediating Artifacts: discussion within the group

Notes on source of primary contradictions (production/consumption): In this observation, the group is working to win a quiz game (prize = chocolate) by answering the most questions correctly. The production-consumption paradox is embodied in the group's object of production of information recall and consumption of their understandings to further activity. The group is successful, although Ty is largely responsible for the group's correct answers.

Primary Contradictions:

Entity	Contradiction within Entity
Subject	Competitors vs. exam reviewers
Mediating Artifacts	Tools for understanding vs. tools for winning
Object	Collaboratively review content for exam vs. get the most right answers as a team
Rules	Prioritize winning vs. prioritize relationships in group
Community	Team of equal contributors vs. team with Ty as intellectual leader
Division of Labor	Intellectual/manual labor distinction vs. horizontal division of labor

Secondary Contradictions: Secondary contradictions exist between -

1. Subject and Tools
2. Community and Division of Labor

Tertiary Contradictions & "Springboards":

Quaternary Contradictions: There did not appear to be any other systems overlapping with activity here as the group was very focused and didn't talk about anything else or reference much in the way of outside concepts or information.

Appendix B

<u>Student Interviews</u>

Interview Protocol - Group Process

11. How does your group go about making decisions and working on a task?
    a. In some groups everyone gets to add to the discussion while in other groups only some group members get to decide. Which is your group more like? Could you give me an example/Tell me more.
    b. Provide an example of a group task students used in the past unit.
12. When group members have different ideas or disagree, how does your group decide which idea to use?
    a. In some groups one group member's ideas are the most often used and in other groups everyone decides. Which is your group more like?
    b. When you disagree, does everyone get a fair chance to have their idea included?
13. Who is influential in your group? How do you know? How do they have influence?
    a. Does everyone have a chance to have influence?
    b. Are the same people influential over time?
    c. Are your contributions heard and taken up/discussed?
    d. What do you do/how do you respond if the group doesn't seem to be including your idea?
14. Are there times when you intentionally wait to say your idea or you choose not to talk?
    c. What reasons do you have for doing that?
15. How comfortable do you feel expressing your views/ideas/opinions in the group? Why?
16. What happens when a group member makes a mistake or is incorrect?
    a. How does the group respond?
    d. Would this be the same for all of your teammates?
17. In what ways, if any, do you benefit from learning with your classmates within your group in science class?
    c. Prompt: What have you learned that you might not learned if you had worked independently?
18. How do you know who has something important to contribute to the group discussion?
19. How much do you think your group learns from the ideas/perspectives you contribute (use participant's language)?
    d. Why do you think this?
20. Do friendships contribute to how well the group works together?
    a. Why do you think this?

Chapter 5: Discussion

The purpose of the present set of studies was to present a developmental lens on middle schoolers' identities: with a focus on early adolescents' social relationships and their concerns with competence, a framework was constructed for marginality and agency in inquiry science collaboration. Further, a sociocultural perspective was employed in constructing the marginality and agency framework; this entailed attending simultaneously to both agency and structure by focusing on interpersonal exchanges among group members and also on collective activity. The developmental and sociocultural focus of the present studies aimed to integrate traditional motivation and development research with the situated models of student identity.

Findings across three elucidate the ways that social aspects of inquiry science collaboration contribute to the construction of marginal identities for middle schoolers. In Study 1, middle schoolers' negotiation of competence was examined as it related to other-regulatory processes. Other-regulators set the tone for negotiation of competence by exerting influence over the way competence was defined for the group: directive other-regulators promoted competitive definitions of competence which were relative, while facilitative other-regulators promoted more inclusive definitions of competence which were mutual. When competence was defined in relative terms, as in directive other-regulated groups, group members engaged in social comparisons and put down their groupmates.

In Studies 2A and 2B, middle schoolers' agency in the face of marginality was explored. Middle schoolers engaged in a range of seven acts of agency that could be

divided into two categories, leveraging resources and managing constrained participation. Marginal group members built on each other's acts of agency and tended to manage constrained participation as a last resort; nonetheless, trajectories of marginality were best explained by differences in the number and flexibility of alliances a marginal group member had inside the group and the marginal group member's ability to contribute during on-task periods. Notably, off-task episodes were a space for marginal group members to build rapport with groupmates and re-engage groupmates.

Finally, in Study 3, constraints on agency in the face of marginality were examined through an activity systems analysis. While all three groups reported having a horizontal division of labor, the division of labor as well as the object of activity were sources of contradictions for all three groups. Instead, contradictions in the rules that were linked to the division of labor differentiated groups in which the construction of long-term marginal identities was observed. Through disputes about leadership and expected levels of contribution for group members, groups with long-term marginal group members arrived at divisions of labor that set the stage for marginal identities: one group's dispute over rules was linked to an intellectual/manual labor divide and the other group's disputes over fairness justified exclusion of a group member who failed to meaningfully contribute and created incentives for other marginal group members to distance themselves from perceived non-contributors.

The three studies here raise concerns in three areas: (1) the role of off-task activity and the social in collaborative learning contexts, (2) the import of competence for sociocultural and situative views of motivation, and (3) the value of a marginality framework for understanding middle schoolers' identities in groupwork. In this chapter,

these two areas will be addressed. Further, implications of the research here will be explicated for researchers focusing on equity in the classroom and teachers and other practitioners attempting to successfully employ sociocultural models of learning in their classrooms. Finally, future research directions will be outlined.

Off-Task Activity and Embracing the Social in Collaborative Learning Environments

One of the most striking findings in this set of studies was the centrality of off-task activity for marginal group members' exercise of agency as well as the fairly frequent off-task talk more generally. Traditionally, off-task talk during group work has been viewed as a nuisance. Indeed, off-task activity is often cited by teachers as a reason they avoid group work in their classrooms. Yet, the results of Study 2 demonstrated that group members facing marginality were able to leverage off-task talk and humor to bring themselves into a more central role within their groups. They joined groupmates' off-task conversations to re-engage them before attempting to bring the group back to task, they turned on-task discussion into a basis for off-task jokes and conversations, and they used off-task talk to build rapport when their social ties to groupmates were weak. In some cases, such as Carson and Arjuna's, the leveraging of off-task talk and humor was linked to an inbound trajectory, which indicates decreasing marginality over the semester. All groups engaged in a great deal of off-task activity during groupwork episodes, though it is worth noting that most groupwork episodes were interspersed with whole-class instruction.

Despite off-task activity's largely negative reputation, the findings of Study 2 suggest that off-task talk may not be wholly negative. This would not be the first study to support the idea that off-task activity is not inherently harmful. Findings by Baker and

colleagues (2004) indicated that different types of off-task activity were linked to different performance outcomes in a cognitive tutor curriculum. Baker and colleagues identified four types of off-task activity: off-task conversation, off-task solitary behavior, inactivity, and gaming the system. Of the four types, only gaming the system, in which students systematically and rapidly gave incorrect answers or used help until a correct answer was given, was significantly associated with reduced post-test scores; additionally, gaming the system was not related to the other forms of off-task activity. Particularly of interest here is the fact that off-task conversation was only marginally significantly associated with post-test scores. Indeed, in this cognitive tutoring context, the form of off-task activity was more important than the quantity of off-task time, which runs counter to much of how we currently treat off-task activity.

Not only is it possible that off-task talk in collaborative learning environments is not wholly negative for students' learning, but it may also be impractical to have a goal of eliminating off-task activity. Yonge and Stables (1998) proposed that it is difficult in practice to distinguish between actual on-task and off-task talk. The results of all three studies here support that claim: off-task activity was often facilitated through nominally on-task talk, which was only identifiable in retrospect, such as in much of Carson's behavior, and on-task activity often was the means for off-task ends, as was the case in the negotiation of competence with directive other-regulated groups. Further, as Study 2's analysis of middle schoolers' agency in inquiry science collaboration demonstrated, off-task activity was a space for resisting marginal identities by building rapport with groupmates or re-engaging them. In a middle school classroom where constraints on time spent with students are a daily challenge for teachers who seek to know their students

personally, it may be onerous and unrealistic to expect teachers to successfully put a stop to students' off-task activity on the whole when the function of off-task episodes is often unclear until after the episode has unfolded. Increased assertion of control on the part of the teacher may also be unwelcomed by students who increasingly desire autonomy.

While the three present studies are limited in their ability to make claims regarding student achievement and off-task activity, these studies taken alongside Baker and colleagues' (2004) finding suggest that we may need to reconsider our approach to off-task activity in collaborative learning environments. In addition to the questions raised about the presumed negative role of off-task activity for learning, research focusing on the classroom social and emotional climate challenges the idea that we should strive to create classrooms that first and foremost maximize productivity at a given moment. From a developmental perspective, early adolescents require a sense of connectedness in school, and construction of identity is considered a central task (Eccles & Roeser, 2011; Juvonen, 2006). Similarly, McCaslin's (2009) coregulation model of emergent identity posits "Am I welcome here?" as a key question students struggle with, representing a tension between a sense of isolation and valued participation (McCaslin et al., 2011).

In a study by Rich and Schachter (2012) the importance of connectedness elaborated to include activities and teachers that actively promote adolescents' growth as "whole individuals" by attending to domains of development that extend beyond academics. Rich and Schachter found that school cultivation of the whole student indeed contributed to high schoolers' identity development; they went on to assert that "exclusive school attention to academic studies, if done in a narrow and constricting

manner, will increase some students' feelings of alienation from school for a number of reasons", some of which include the perception that faculty do not connect with them as unique persons or connect with the parts of the student that the student finds most important (p. 225). Their claim is reminiscent of criticisms of curricula that fail to achieve cultural relevance for students of color (Brown-Jeffy & Cooper, 2011; Wortham & Contreras, 2002).

When we shift away from notions of productivity and academic performance and instead refocus on early adolescents' identities as whole persons, we are able to attend to learning in a more nuanced way. The present studies specifically highlight how this shift can counterintuitively offer us a richer picture of concepts such as disciplinary identity and practice-linked identity. By de-privileging students' relationships with content and honing in on students' relationships with themselves and others, the studies here elaborated the ways that off-task activity can be a lifeline for students who are on a marginal identity trajectory as well as the ways that on-task activity can be used by some students to facilitate the exclusion of others.

The Import of Competence for Sociocultural and Situative Perspectives on Motivation

Taken together, the present studies not only challenged common conceptions of off-task activity, but also offered evidence suggesting that we may benefit from revisiting the traditional motivation construct of competence. The shift toward sociocultural analyses of learning and related processes has been accompanied by a shift away from discussing the role of individual-oriented constructs. Yet, the findings here suggest that even sociocultural models of learning, motivation, and identity will have reduced explanatory power and applicability if they do not incorporate a focus on competence

motivation in the middle school years. Gresalfi and colleagues' (2009) activity systems analysis conceptualized competence as "an interaction between the opportunities a student has to participate competently and the ways that individual takes up those opportunities", rather than an attribute essential to an individual student (p. 50). In an extension of Gresalfi and colleagues' (2009) discussion of how competence is negotiated in classroom-level activity, Study 1 demonstrated that students indeed negotiate competence within small groups as well. This was to be expected since competence was framed as emerging from collective activity: there are multiple, overlapping activity systems in any given context.

Beyond the contributions of Study 1 in clarifying the negotiated nature of competence, Studies 2 and 3 also gave depth to our understanding of competence as a socioculturally-contextualized construct. In Study 2, competence-relevant messages were both part of how marginality was defined and part of how group members exercised agency (i.e. leveraging status hierarchies). Here, marginality was defined as a negotiated positional identity emerging out of social interaction that involves short- or long-term social isolation. As the indicators of marginality were developed in the context of middle school science collaboration, social isolation more often than not involved the rejection or omission of a group member's ideas or restriction of a group member's ability to contribute to group products.

Nonetheless, a limitation of the aforementioned studies is that they do not directly address the impact of negotiated competence on students' perceptions of themselves. Previous research addressing academic self-concept indicates that students' self-perceptions matter and suggest that it is therefore necessary to link the observed

negotiation of competence to self-perceptions. Students' self-perceptions of competence from a sociocultural perspective can be understood as internalized messages from the social context coming together with individual students' own understandings. A thorough application of a sociocultural lens to competence will involve addressing both social sources of messages about the self as well as the cognitive and affective internal messages that inform self-perceptions.

While the notion systems of competence captures the social sources of messages that become internalized, the internal aspects of competence still stand to be addressed. The negotiation of competence observed in Study 1 offers more insight regarding the internal aspects, but still was limited by in what was offered about students' beliefs. Sociocultural perspectives on motivation aim to avoid the much criticized overemphasis on the individual by focusing on interactions; thus, traditional motivation research may be able to be bridged with sociocultural models if researchers find ways to address students' understandings of themselves through analyses of students' interactions in social contexts. The examination of marginal identities helps clarify a sociocultural perspective on competence by examining competence-relevant discourse in students' social interactions and analyzing observations in tandem with students' interviews.

Marginality: A Framework for Understanding Identity and Agency in Middle School?

One of the main goals of the present set of studies was to develop a framework for marginality, thereby accounting for both the fluidity and stability of the identities of socially isolated students. In conceptualizing marginality, the studies aimed to more thoroughly account for students' agency, avoid identity essentialism and deficit thinking, and capture the dynamic nature of identity construction through a developmental

methodology. To achieve these goals, marginality was conceptualized as a negotiated positional identity that is inherently relational. As positional identities are understood as negotiated, a marginal positional identity was defined as emerging from social interactions in which all parties exercised some degree of agency, hence in Studies 1 and 2 it was important to account for how features of positional identities were constructed and reconstructed from moment to moment (Holland et al., 1998). Additionally, in accounting for marginality's stability, Study 3 attended to the ways agency can be constrained.

The rationale for creating a marginality framework was the lack of fit of existing models of identity and social isolation for addressing students in relation to each other. Pre-existing models did not account for the construction of the identity, as was the case with the status problems literature, or else were not oriented to understanding the social side of middle schoolers' motivation and identity. In the status problems literature, constraints on agency are generally captured by appealing to social structures and presuming that membership in some socially disadvantaged group leads to low status in groupwork contexts. Nonetheless a limitation of this approach is that it cannot explain situations in which two students who are both members of a socially disadvantaged group experience different outcomes because the focus of this research has not been to examine moment to moment interactions.

More recent identity research focused on the moment to moment interaction level avoids assuming that group membership is the primary driver of social exclusion and isolation, as is the case with research focused on practice-linked identities and disciplinary identities. Disciplinary and practice-linked identity models generally afford

explanation of how students come to view themselves as doers of a given discipline, such as science or math. Likewise, disciplinary and practice-linked identity research often addresses depth of students' relationships with content, opportunities to exercise agency in relation to the content, and the ways that instructional formats constrain students' agency in relation to content. One line of disciplinary and practice-linked identity research that diverges from this general pattern somewhat is research on critical science identity (Basu et al., 2009). Critical science agency captures students' relationships with content and the discipline as a whole and it does so by emphasizing the ways that students use the discipline to effect change on the world around them. Thus, critical science agency begins to address aspects of students' social identities that go beyond the purely academic.

Nonetheless, there have been challenges in avoiding a representation of agency as structurally determined and in explaining situations in which a structurally-deterministic account is untenable. While recent identity research emphasizing negotiability and agency avoids structural determinism, it has not adequately accounted for and expanded upon the realities that the status literature so strikingly highlights. The present studies begin to offer an account of agency *and* structure by shifting the focus of analysis across three studies to make a larger case for the ways individuals' actions come together in activity to construct the structures that constrain agency, though the study only offers limited explanation of how larger social structures permeate small group interaction. Here, widely valued social constructs such as competence are demonstrated to be both negotiated in small group interaction and be reproductive larger cultural conceptions of what competence is and what its consequences should be: group members positioned

each other as competent and incompetent for purposes of restricting access to other-regulator roles, influence, and opportunities to participate.

While the present studies did not examine activity systems beyond the collaborative group, the reproduction of competence as a cultural construct at the small group level may represent the permeation of a socially-valued hierarchical division of labor (Llorente, 2006). As with the hierarchical division of labor in society that has been described as cultivating cognitive and psychological impoverishment and socioeconomic disempowerment, the framing of competence as a scarce resource in a zero-sum game also led to social disempowerment and intellectual impoverishment by normalizing exclusion. Further, that exclusion was justified by invoking hierarchies of intellectual ability to determine who had the right to make decisions in the group and to entitle some to make decisions on behalf of the rest of the group.

Further, the present set of the studies addresses a limitation of the communities of practice model: the marginality framework developed here captures the role of the community in constraining individuals' trajectories of participation. In the communities of practice model, Wenger (1998) conceptualizes marginality as being a matter of participation trajectories: a marginal group member can have an inbound trajectory in which he or she becomes a more central participant over time or an outbound trajectory in which one becomes a less central participant in a community over time. This notion of participation trajectories in communities of practice makes no assumption about whether an individual necessarily wants to be a member of the community, and thus accommodates the possibility that an individual may actively pursue exit from group membership and participation or be content with stability as a nonparticipant. For

example, a person may choose to exit the community of practice because he or she simply is no longer interested in the practices of the community or the person could choose to deliberately not pursue greater centrality in the community. Engeström (2007) claimed that the communities of practice model itself does not adequately situate collectives historically, which further challenges the communities of practice model's ability to address collectives as enactors of structure at the local level.

Despite employing the language of negotiability, Wenger (1998) only in passing discusses the possibility that a community of practice may deliberately seek to force a group member out against his or her desires. Thus, the communities of practice model uses trajectories to emphasize changes in a participant's positionality, but speaks little about the role of the group in shaping positional identities; instances commonly described as exclusion are largely unaddressed. In order to emphasize agency, the communities of practice model undertheorizes the possibility that individuals use their agency in order to constrain that of someone else. This may explain the emphasis on changing identities in research employing the communities of practice model, as well: in focusing on agency as the basis for changes in identity, discussion of identities that are largely stable in practice is likely to be omitted. The MARGINI model of marginality in social psychology theorizes about this area that goes unaddressed in Wenger's (1998) account, although the MARGINI model defines marginal identity as being a less prototypical member of a given group (Ellemers & Jetten, 2013).

Ellemers and Jetten's (2013) MARGINI model made the important step of distinguishing between the goals of the individual and the goals of the group, rather than presuming some overarching goal of increased inclusion in a community; this attention to

goals of the group and goals of the individual of the model influenced the present

conceptualization of marginality as well. While the MARGINI model treated individual

goals and group goals as distinct from one another, the marginality framework developed

in the present studies treated individual and group goals as mutually constituting. The

qualitative account of each group member's trajectory of marginality offered evidence

that individuals modify their goals in the face of constraints on agency, as was the case

with Greg's late adoption of a non-participation strategy. Further, the present studies

highlighted how individual group members' goals shape goals at the group level, such as

when Carson's goal of extracting answers from Leesha and Luke led Leesha and Luke to

adopt a practice of insisting on working in pairs to avoid interacting with Carson. While

the marginality framework developed in the present set of studies contributes by

capturing the role of the group in constraining agency and offering a way to examine the

construction of status hierarchies found in the existing status literature, a number of

concerns still exist that have not been accounted for in the framework. The framework

theoretically has the capacity to address the long-term forms of marginality, or

marginalization, that the status literature has traditionally addressed, but the framework

does not explicitly account for marginality that is due to group membership.

Despite the potential shortcomings of the framework, marginality is likely to be a

fruitful way of examining identity in early adolescence. The marginality framework

presented here has two features that make it especially fitting for understanding identity

in the middle school years. First, the framework explicitly addresses relationships

between people in the classroom. Findings emphasizing the importance of social

relationships in early adolescence support the notion that accounts of early adolescent

identity should include a focus on interpersonal relationships. For early adolescents, relationships with peers and school personnel are likely to have influence on even disciplinary identities. As McCaslin and colleagues (2011) highlighted, collaborative learning contexts can also bring emotional concerns to the forefront, raising challenges of dealing with feelings of guilt or shame; Rogat and Adams-Wiggins (in press) also found that controlling forms of other-regulation was associated with negative socioemotional interactions while facilitative forms of other-regulation brought positive socioemotional interactions, which were characterized by inclusivity. Study 1's results demonstrated that middle schoolers can and do explicitly discourage participation using competence-relevant putdowns (i.e. "Don't ever grow up to be a scientist"). Similarly, Studies 2 and 3 clarified the more implicit ways that interpersonal relationships may influence disciplinary identities: Greg was told by Leesha how his answers were "too awful" when she felt he was not contributing enough and this resulted in Leesha and Luke both avoiding working with Greg. Carson eventually rejected Greg, as well. These findings highlight the importance of having a way to capture interpersonal relationships' relevance for identity in early adolescence when attempting to understand students' experiences of isolation and exclusion. In collaborative learning environments, the relevance of the interpersonal level becomes even more critical.

Second, the framework centers competence as a motivational concern for students during groupwork. Study 1 demonstrated the centrality of competence-relevant messages during collaboration for middle schoolers This finding was somewhat expected in light of previous research emphasizing the increase in social comparison and a focus on performance goals after the transition to middle school (Roeser & Eccles, 2000; Ryan &

Patrick, 2001). Further, in developing the framework for Studies 2 and 3, marginality

indicators were developed from both student interviews and videotaped groupwork

observations to capture a wide range of observable acts that indicated a group member

was becoming isolated within the group or losing access to participation. The

marginality indicators thus involved implicit messages about competence: deference to

others, low academic performance, being pushed out of group talk, being targeted for

ridicule, and unequal evaluation of peer work were all indicators of marginality.

Overall, the marginality model outlined in the three studies here offers

possibilities for more deeply exploring the social side of students as "whole persons".

Students in early adolescence have motivational concerns that involve their perceptions

of their competence for themselves and others as well as concerns involving their social

lives. The three studies here demonstrate that there is much to be explored in these two

areas using a sociocultural lens. The interplay of individual agency and group-level

constraints on agency were only able to be captured by addressing both the interpersonal

interaction level with a focus on individuals and then shifting to a focus on collective

activity as the unit of analysis.

Implications for Educational Equity

Boaler's (2008) research on relational equity demonstrated the importance of

attending to the social and relational side of collaborative learning in when pursuing

equity goals. Boaler noted that learning to have equitable relationships in school will

impact students' willingness to ensure equitable opportunities for all both inside and

outside the classroom. Specifically, respect for others' ideas, commitment others'

learning in addition to one's own, and equitable and supportive modes of communication

are representative of relational equity. The importance of respect for others' ideas has also been a recurring theme in research on how to best support students motivationally and emotionally (Juvonen, 2006; Ryan & Patrick, 2001; Rogat & Adams-Wiggins, in press). The present studies further clarify the value of interactions between students by extending Cohen's status problems research: the findings here suggest that curriculum designers not only must plan for the inclusion of low-status students, but also the integration of features that afford equitable interactions that support positive views of self and foster strong relationships with the discipline for all students. The findings also suggest that teachers may benefit from more extensive professional development on facilitating groups that adopt practices supporting high-quality motivation.

Further, the results of the studies presented here offer insight into the local interactions that produce marginal identities. The marginality framework constructed in the present set of studies may help researchers dealing with the challenge of explaining the differential outcomes observed for members of marginalized group and phenomena such as "colorblind racism" (Bonilla-Silva, 2006). Interactions like those observed for Luke and Shonyce strongly suggest that students experience microaggressions regarding race and gender as early as middle school and are forced to develop means of coping in the midst of other pressing academic and social concerns. Interviews and field notes not analyzed in the present set of studies also evidenced socially accepted language implicitly racializing competence: a recurring theme in interviews was that there were "serious" and "unserious" students, yet descriptions of "unserious" students typically depicted boys who in some way participated in hip-hop culture. This is an area deserving of deeper exploration, especially in light of findings by Khalifa (2013) indicating that culturally

responsive school leaders recognize and validate students' performances of hip-hop culture.

Implications for Practice

Results from the present studies offer insight into the ways that students make use of new-found autonomy in middle school classrooms. Though many studies emphasize the benefits of curricula that shift authority into the hands of students (e.g. Cornelius & Herrenkohl, 2004), the findings here further demonstrate areas in which middle schoolers are likely to need support if groups are to function well. Roseth, Johnson, and Johnson's (2008) meta-analysis indicated the importance of cooperative goal structures for students' achievement and peer relationships in early adolescence; their findings support social interdependence approaches to collaborative learning (Johnson & Johnson, 2006). Students may benefit from continuous training on skills for groupwork throughout the school year, with opportunities offered for students to reflect on their past experiences within groups. Additionally, findings in the present study indicated that off-task activity could be a space for resisting marginal identities. While teachers should continue to take off-task activity seriously in the classroom, they should be aware of the challenges in distinguishing between beneficial forms of off-task activity and detrimental types. Baker and colleagues' (2004) findings suggest that the difference may be related to students' goals for learning.

Limitations

The present studies offer a conceptualization of middle schoolers' identities in inquiry science from a developmental and sociocultural perspective. Nonetheless, findings should be understood within the context of the studies' limitations. First, the

present studies did not systematically account for broader social categories found in the traditional status problems literature, such as marginalized racial and gender groups. Additionally, while the studies took place in ethnically-diverse middle schools, Studies 2 and 3 had limited membership by African-American and Latino/a students in observed groups. Thus, it is difficult to offer theoretical statements regarding the role of racial status hierarchies and gender status hierarchies in marginal identity construction. Race and gender status hierarchies are very likely to be relevant in the construction of marginal identities in light of extant research findings (Cohen & Lotan, 1997; Leander, 2002).

Second, the role of stability of group membership was not addressed in the present set of studies. In Studies 2 and 3, groups were deliberately selected for their mostly stable group membership over the course of a semester. This raises the question of whether groups that are unstable would yield similar findings. The results of Study 2 suggest that changes in group membership were indeed relevant for marginal identities: outbound Group F member, Shonyce, became marginal as the change in her group's membership also entailed a change in the group's gender composition, which involved the removal of the only clear ally she had in the group. Further, Group F's Ty had a shift in his interactions with the group when Paul joined the group. Changes in group membership in the present studies may also have been linked to teacher preferences, as the two teachers included in Studies 2 and 3 were the only teachers' who opted not to reconfigure students' groups within or between units. It is important to explore whether teachers' choices about reconfiguring their groups are linked to other relevant teacher characteristics.

Finally, the present studies focused primarily on marginal students in order to conceptualize marginal identities in inquiry science. In Study 1, the negotiation of competence was examined by addressing how all group members individually positioned themselves as well as how their groupmates positioned them. In Studies 2 and 3, the focused turned directly to those positioned as incompetent by examining marginal group members' agency and trajectories of marginality in the context of group activity, which was conceptualized as a constraint on agency. Yet, in focusing primarily on marginal group members, there was a de-emphasis on non-marginal group members. While the studies spoke to how marginal group members could become central and how once central members could become marginal, the present set of studies is limited in its explanation of how central group members go about retaining their centrality over the course of a semester. Findings in research on other-regulation suggest that this is an important question for study (Rogat & Adams-Wiggins, 2014).

Future Directions

The studies presented here outline a framework for understanding middle schoolers' identity and agency from a sociocultural and developmental perspective. Beyond the framework's promise for bringing the social and emotional side of learning to the fore, the results of these three studies suggest that researchers may need to shift between different levels of analysis in order to describe agency in ways that give adequate attention to the role of social structure in constraining agency. Studies involving multiple analytical angles are needed in order to marginality in the classroom, which requires a focus on competence using a sociocultural lens. Further, the marginality

and agency frameworks developed in the present studies should be validated for their appropriateness in addressing more long-term forms of marginality.

Conclusions

In recent years, there has been an increased emphasis on understanding the identities of learners from sociocultural perspective. Research in this vein has generally focused on discipline-linked identity and relationships between the student and the discipline; less attention has been devoted to the role of students' relationships with each other in sociocultural studies of identity. In light of current empirical evidence, the study of students' identities in school should include a focus on development. Here, the case has been made for attending to peer relationships and competence in studies of early adolescents' identities in the classroom. Despite limitations in the present study with regards to accounting for the role of teachers and school culture for shaping marginal identity trajectories, there is strong evidence for the importance a group climate that reduces threats to students' sense of competence. Further, despite limitations in accounting for the unique marginality experiences of underrepresented minority students, there was evidence here that gender composition of groups is likely to bear on marginality identity trajectories. Thus, while discipline-linked identity research has made a great deal of progress in theorizing and explaining learners' engagement in the classroom, explorations of the social and developmental side of learners' identities are likely to contribute to our understanding of discipline-linked identities, as well. Hopefully, the present set of studies has contributed to the discussion of the multifaceted identities of students in school.

References

Altermatt, E. R., Pomerantz, E. M., Ruble, D. N., Frey, K. S., & Greulich, F. K. (2002). Predicting changes in children's self-perceptions of academic competence: A naturalistic examination of evaluative discourse among classmates. *Developmental Psychology*, *38*(6), 903.

Baker, R. S., Corbett, A. T., Koedinger, K. R., & Wagner, A. Z. (April, 2004). Off-task behavior in the cognitive tutor classroom: when students game the system. In *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 383-390). ACM.

Basu, S. J., Barton, A. C., Clairmont, N., & Locke, D. (2009). Developing a framework for critical science agency through case study in a conceptual physics context. *Cultural studies of science education*, *4*(2), 345-371.

Boaler, J. (2008). Promoting 'relational equity' and high mathematics achievement through an innovative mixed-ability approach. British Educational Research Journal, *34*(2), 167-194.

Bonilla-Silva, E. (2006). *Racism without racists: Color-blind racism and the persistence of racial inequality in the United States*. Rowman & Littlefield Publishers.

Brown-Jeffy, S., & Cooper, J. E. (2011). Toward a conceptual framework of culturally relevant pedagogy: An overview of the conceptual and theoretical literature. *Teacher Education Quarterly*, 65-84.

Cornelius, L. L., & Herrenkohl, L. R. (2004). Power in the classroom: How the classroom environment shapes students' relationships with each other and with concepts. *Cognition and Instruction, 22*(4), 467-498.

Eccles, J. S., & Roeser, R. W. (2011). Schools as developmental contexts during adolescence. *Journal of research on adolescence*, *21*(1), 225-241.

Ellemers, N., & Jetten, J. (2013). The many ways to be marginal in a group. *Personality and Social Psychology Review, 17*(1), 3-21.

Engeström, Y. (2007). From communities of practice to mycorrhizae. In J. Hughes, N. Jewson & L. Unwin (Eds.), *Communities of Practice: Critical Perspectives* (pp. 41-54). London: Routledge.

Gresalfi, M., Martin, T., Hand, V., & Greeno, J. (2009). Constructing competence: An analysis of student participation in the activity systems of mathematics classrooms. *Educational Studies in Mathematics, 70*(1), 49-70.

Holland, D., Lachicotte, W. J., Skinner, D., & Cain, C. (1998). *Identity and agency in cultural worlds*. Cambridge, MA: Harvard University Press.

Johnson, D. W., & Johnson, F. (2006). *Joining together: Group theory and group skills* (9th ed.). Boston: Allyn & Bacon.

Juvonen, J. (2007). Reforming middle schools: Focus on continuity, social connectedness, and engagement. *Educational Psychologist*, *42*(4), 197-208.

Khalifa, M. Creating spaces for urban youth: The emergence of culturally responsive (hip-hop) school leadership and pedagogy. *Multicultural Learning and Teaching*, *8*(2), 63-93.

Llorente, R. (2006). Analytical Marxism and the division of labor. *Science & Society*, 232-251.

McCaslin, M. (2009). Co-regulation of student motivation and emergent identity. *Educational Psychologist*, *44*(2), 137-146.

McCaslin, M., Vega, R. I., Anderson, E. E., Calderon, C. N., & Labistre, A. M. (2011). Navigating and negotiating in small-group learning. *Sociocultural Theories of Learning and Motivation: Looking Back, Looking Forward*, *10*, 191.

Rich, Y., & Schachter, E. P. (2012). High school identity climate and student identity development. *Contemporary Educational Psychology*, *37*(3), 218-228.

Rogat, T.K. & Adams-Wiggins, K.R. (in press). Facilitative versus directive other-regulation in collaborative groups: Implications for socioemotional interactions. *Computers in Human Behavior.*

Rogat, T.K., & Adams-Wiggins, K.R. (2014). Other-regulation in collaborative groups: Implications for regulation quality. *Instructional Science,* 1-26.

Roeser, R. W., Eccles, J. S., & Sameroff, A. J. (2000). School as a context of early adolescents' academic and social-emotional development: A summary of research findings. *The Elementary School Journal*, 443-471.

Roseth, C. J., Johnson, D. W., & Johnson, R. T. (2008). Promoting early adolescents' achievement and peer relationships: the effects of cooperative, competitive, and individualistic goal structures. *Psychological bulletin*, *134*(2), 223.

Ryan, A. M., & Patrick, H. (2001). The classroom social environment and changes in

adolescents' motivation and engagement during middle school. *American Educational Research Journal*, *38*(2), 437-460.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity.* New York, NY: Cambridge University Press.

Wortham, S., & Contreras, M. (2002). Struggling toward culturally relevant pedagogy in the Latino diaspora. *Journal of Latinos and Education*, *1*(2), 133-144.

Yonge, C., & Stables, A. (1998). 'I am It the Clown': Problematising the Distinction Between 'Off Task' and 'On Task' Classroom Talk. *Language and Education*, *12*(1), 55-70.

Acknowledgement of Prior Publication

Study 1, found in Chapter 1 of this dissertation, was previously published in the Proceedings of the Computer Supported Collaborative Learning Conference in 2013.

Bibliography

Adams-Wiggins, K. R., & Rogat, T. K. (2013). Variation in other-regulation and the implications for competence negotiation. *Proceedings of the 10th Computer-Supported Collaborative Learning Conference*, Madison, WI.

Altermatt, E. R., Pomerantz, E. M., Ruble, D. N., Frey, K. S., & Greulich, F. K. (2002). Predicting changes in children's self-perceptions of academic competence: A naturalistic examination of evaluative discourse among classmates. *Developmental Psychology*, *38*(6), 903.

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84*, 261-271.

Angelillo, C., Rogoff, B., & Chavajay, P. (2007). Examining shared endeavors by abstracting video coding schemes with fidelity to cases. *Video research in the learning sciences*, 189-206.

Baard, P. P., Deci, E. L., & Ryan, R. M. (2004). Intrinsic Need Satisfaction: A Motivational Basis of Performance and Weil-Being in Two Work Settings. *Journal of Applied Social Psychology*, *34*(10), 2045-2068.

Baker, R. S., Corbett, A. T., Koedinger, K. R., & Wagner, A. Z. (April, 2004). Off-task behavior in the cognitive tutor classroom: when students game the system. In *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 383-390). ACM.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*, *84*(2), 191.

Barron, B. (2000). Achieving coordination in collaborative problem-solving groups. *The Journal of the Learning Sciences, 9*(4), 403-436.

Barron, B. (2003). When smart groups fail. *The Journal of the Learning Sciences*, *12*(3), 307-359.

Barton, A. C., & Tan, E. (2010). We be burnin'! Agency, identity, and science learning. *The Journal of the Learning Sciences*, *19*(2), 187-229.

Basu, S. J., Barton, A. C., Clairmont, N., & Locke, D. (2009). Developing a framework for critical science agency through case study in a conceptual physics context. Cultural studies of science education, 4(2), 345-371.

Baxter Magolda, M. B. (2000). Interpersonal Maturity: Integrating Agency and Communion. *Journal of College Student Development*, *41*(2), 141-56.

Bianchini, J. A. (1997). Where knowledge construction, equity, and context intersect: Student learning of science in small groups. Journal of Research in Science Teaching, *34*(10), 1039-1065.

Boaler, J. (2008). Promoting 'relational equity' and high mathematics achievement through an innovative mixed-ability approach. British Educational Research Journal, *34*(2), 167-194.

Bong, M., & Clark, R. E. (1999). Comparison between self-concept and self-efficacy in academic motivation research. *Educational psychologist*, *34*(3), 139-153.

Bong, M., & Skaalvik, E. M. (2003). Academic self-concept and self-efficacy: How different are they really?. *Educational psychology review*, *15*(1), 1-40.

Bonilla-Silva, E. (2006). Racism without racists: Color-blind racism and the persistence of racial inequality in the United States. Rowman & Littlefield Publishers.

Brown-Jeffy, S., & Cooper, J. E. (2011). Toward a conceptual framework of culturally relevant pedagogy: An overview of the conceptual and theoretical literature. *Teacher Education Quarterly*, 65-84.

Carlone, H. B., Scott, C. M., & Lowder, C. (2014). Becoming (less) scientific: A longitudinal study of students' identity work from elementary to middle school science. *Journal of Research in Science Teaching*, *51*(7), 836-869.

Chinn, C. A., & Buckland, L. A. (2011). Differences in epistemic practices among scientists, young earth creationists, intelligent design creationists, and the scientist creationists of Darwin's era. In R. Taylor and M. Ferrari (Eds.), *Epistemology and science education: Understanding the evolution vs. intelligent design controversy* (pp. 38-76). New York: Taylor & Francis.

Chinn, C. A., Duschl, R. A., & Duncan, R. G., Buckland, L. A., Pluta, W.P. (2008). A microgenetic classroom study of learning to reason scientifically through modeling and argumentation. *Proceedings of the 8th International Conference on International Conference for the Learning Sciences,* Utrecht, Netherlands.

Cobb, P., Gresalfi, M., & Hodge, L. L. (2009). An interpretive scheme for analyzing the identities that students develop in mathematics classrooms. *Journal for Research in Mathematics Education, 40*(1), 40-68.

Cohen, E. G. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research*, *64*(1), 1-35.

Cohen, E. G., & Lotan, R. A. (1997). *Working for equity in heterogeneous classrooms:*

Sociological theory in practice. New York, NY: Teachers College Press.

Cole, M., John-Steiner, V., Scribner, S., & Souberman, E. (1978). *L.S. Vygotsky: Mind in society, the development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Cornelius, L. L., & Herrenkohl, L. R. (2004). Power in the classroom: How the classroom environment shapes students' relationships with each other and with concepts. *Cognition and Instruction, 22*(4), 467-498.

Côté, J.E., & Levine, C.G. (2002). *Identity, formation, agency, and culture: A social psychological synthesis*. Mahwah, NJ: Lawrence Erlbaum Associates.

Darnon, C., Muller, D., Schrager, S. M., Pannuzzo, N., & Butera, F. (2006). Mastery and performance goals predict epistemic and relational conflict regulation. *Journal of Educational Psychology*, *98*(4), 766.

Davies, B., & Harré, R. (1990). Positioning: The discursive production of selves. *Journal for the Theory of Social Behaviour, 20*(1), 43-63.

Davies, B., & Hunt, R. (1994). Classroom competencies and marginal positionings. *British Journal of Sociology of Education, 15*(3), 389-408.

Duncan, R. G., Freidenreich, H. B., Chinn, C. A., & Bausch, A. (2011). Promoting middle-school students' understanding of molecular genetics. *Research in Science Education, 41*, 147-167.

Eccles, J. S., & Midgley, C. (1989). Stage-environment fit: Developmentally appropriate classrooms for young adolescents. *Research on motivation in education*, *3*, 139-186.

Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., & Mac Iver, D. (1993). Development during adolescence: the impact of stage-environment fit on young adolescents' experiences in schools and in families. *American psychologist*, *48*(2), 90.

Eccles, J. S., Buchanan, C. M., Flanagan, C., Fuligni, A., Midgley, C., & Yee, D. (1991). Control versus autonomy during early adolescence. *Journal of Social Issues*, *47*(4), 53-68.

Eccles, J. S., & Roeser, R. W. (2011). Schools as developmental contexts during adolescence. *Journal of research on adolescence*, *21*(1), 225-241.

Eccles, J. S., & Roeser, R. W. (2009). Schools, academic motivation, and stage-environment fit. *Handbook of adolescent psychology*.

Eccles, J. S., Wigfield, A. & Schiefele, U. (1998). Motivation to succeed. Damon, William, Eisenberg, Nancy [Ed]. Handbook of child psychology, 5th ed.: Vol 3. Social, emotional, and personality development. Hoboken, NJ, US: John Wiley & Sons Inc, US; pp. 1017-1095.

Ellemers, N., & Jetten, J. (2013). The many ways to be marginal in a group. *Personality and Social Psychology Review, 17*(1), 3-21.

Engeström, Y. (2007). From communities of practice to mycorrhizae. In J. Hughes, N. Jewson & L. Unwin (Eds.), *Communities of Practice: Critical Perspectives* (pp. 41-54). London: Routledge.

Engeström, Y., & Miettinen, R. (1999). Introduction. In Y. Engeström, R. Miettinen & R. Punamaki (Eds.), *Perspectives on activity theory* (pp. 1-18). USA: Cambridge University Press.

Esmonde, I. (2009). Mathematics learning in groups: Analyzing equity in two cooperative activity structures. *The Journal of the Learning Sciences, 18*(2), 247-284.

Faircloth, B. S. (2012). "Wearing a mask" vs. connecting identity with learning. *Contemporary Educational Psychology*, *37*(3), 186-194.

Gannon, S., & Davies, B. (2012). Postmodern, post-structural, and critical theories. In S. N. Hesse-Biber (Ed.), *Handbook of Feminist Research: Theory and Praxis* (2nd ed., pp. 65-91). Washington DC: Sage.

Garcia-Reid, P. (2007). Examining social capital as a mechanism for improving school engagement among low income Hispanic girls. *Youth & Society*.

González, G., & DeJarnette, A. F. (2012). Agency in a geometry review lesson: A linguistic view on teacher and student division of labor. *Linguistics and Education*, *23*(2), 182-199.

Graham, S. & Golan, S. (1991). Motivational influences on cognition: Task involvement, ego involvement, and depth of processing. *Journal of Educational Psychology, 83,* 187-194.

Grant, H. & Dweck, C. (2003). Clarifying achievement goals and their impact. *Journal of Personality and Social Psychology, 85(3),* 541-553.

Gresalfi, M.S. (2009). Taking up opportunities to learn: Constructing dispositions in mathematics classrooms. *Journal of the Learning Sciences, 18,* 327-369.

Gresalfi, M., Martin, T., Hand, V., & Greeno, J. (2009). Constructing competence: An

analysis of student participation in the activity systems of mathematics classrooms. *Educational Studies in Mathematics, 70*(1), 49-70.

Gutiérrez, K. D., & Rogoff, B. (2003). Cultural ways of learning: Individual traits or repertoires of practice. *Educational Researcher, 32*(5), 19-25.

Hadwin, A., & Oshige, M. (2011). Self-regulation, coregulation, and socially shared regulation: Exploring perspectives of social in self-regulated learning theory. *Teachers College Record*, *113*, 240–264.

Hand, V. M. (2010). The co-construction of opposition in a low-track mathematics classroom. *American Educational Research Journal, 47*(1), 97-132.

Harré, R., & Van Lagenhove, L. (1999). Positioning theory: Moral contexts of international action. Malden, MA: Blackwell Publishers.

Hickey, D. T. (2003). Engaged participation versus marginal nonparticipation: A stridently sociocultural approach to achievement motivation. *The Elementary School Journal, 103*(4), 401-429.

Hogan, K., Nastasi, B., & Pressley, M. (1999). Discourse patterns and collaborative scientific reasoning in peer and teacher-guided discussions. *Cognition and Instruction*, *17*, 379-432.

hooks, b. (1990). ''Marginality as a Site of Resistance.*'' Out There: Marginalization and Contemporary Cultures*. Eds. R. Ferguson, M. Gever, T. T. Minh-ha, and C. West. Cambridge: MIT, 341-343.

Holland, D., Lachicotte, W. J., Skinner, D., & Cain, C. (1998). *Identity and agency in cultural worlds*. Cambridge, MA: Harvard University Press

Jackson, P. A., & Seiler, G. (2013). Science identity trajectories of latecomers to science in college. *Journal of Research in Science Teaching*, *50*(7), 826-857.

Järvelä, S. & Järvenoja, H. (2011). Socially constructed self-regulated learning and motivation regulation in collaborative learning groups. *Teachers College Record*, *113*, 350–374.

Johnson, D. W., & Johnson, F. (2006). *Joining together: Group theory and group skills* (9th ed.). Boston: Allyn & Bacon.

Jurow, A. S. (2005). Shifting engagements in figured worlds: Middle school mathematics students' participation in an architectural design project. *Journal of the Learning Sciences, 14*, 35-67.

Juvonen, J. (2007). Reforming middle schools: Focus on continuity, social connectedness, and engagement. *Educational Psychologist*, *42*(4), 197-208.

Kempler, T.M. & Linnenbrink, E.A. (2004, April). *Re-examining the influence of competition structures in group contexts: Implications for social and cognitive interactions in small groups.* Paper presented at the Annual Convention of the American Educational Research Association, San Diego.

Khalifa, M. (2013). Creating spaces for urban youth: The emergence of culturally responsive (hip-hop) school leadership and pedagogy. *Multicultural Learning and Teaching*, *8*(2), 63-93.

Kirschner, S. R., & Martin, J. (2010). The sociocultural turn in psychology: An introduction and an invitation. In S. R. Kirschner & J. Martin (Eds.), *The sociocultural turn in psychology: The contextual emergence of mind and self* (pp. 1-27). New York, NY, US: Columbia University Press.

Kurth, L. A., Anderson, C. W., & Palincsar, A. S. (2002). The case of Carla: Dilemmas of helping all students to understand science. *Science Education, 86*(3), 287-313.

Langer-Osuna, J. M. (2011). How Brianna became bossy and Kofi came out smart: Understanding the trajectories of identity and engagement for two group leaders in a project-based mathematics classroom. *Canadian Journal of Science, Mathematics and Technology Education, 11*(3), 207-225.

Langer-Osuna, J. M., & Engle, R. A. (2010). I study features; believe me, I should know!: The mediational role of distributed expertise in the development of student authority. *Proceedings of the 9th International Conference of the Learning Sciences*, Chicago, IL.

Leander, K. M. (2002). Locating Latanya: The situated production of identity artifacts in classroom interaction". *Research in the Teaching of English*, *37*, 198-250.

Leander, K. M. (2004). "They took out the wrong context": Uses of time-space in the practice of positioning. *Ethos, 32*(2), 188-213.

Levy, I., Kaplan, A., & Patrick, H. (2004). Early adolescents' achievement goals, social status, and attitudes towards cooperation with peers. *Social Psychology of Education*, *7*(2), 127-159.

Li, Y., Anderson, R. C., Nguyen-Jahiel, K., Dong, T., Archodidou, A., Kim, I.H., Kuo, L.J, Clark, A.M., Wu, X., Jadallah, M., & Miller, B. (2007). Emergent leadership in children's discussion groups. *Cognition and Instruction, 25*, 75-111.

Linnenbrink, E.A. & Pintrich, P.R. (2000). Multiple pathways to learning and

achievement: *The role of goal orientation in fostering adaptive motivation, affect, and cognition*. Sansone, C., & Harackiewicz, J.M. (Eds.). Intrinsic and extrinsic motivation: The search for optimal motivation and performance. San Diego, CA, US: Academic Press

Llorente, R. (2006). Analytical Marxism and the division of labor. *Science & Society*, 232-251.

Lotan, R. A. (2003). Group-worthy tasks. *Educational Leadership, 60*(6), 72-75.

Magnusson, E., & Marecek, J. (2010). Sociocultural means to feminist ends: Discursive and constructionist psychologies of gender. In S.R. Kirschner, & J. Martin (Eds.), *The sociocultural turn in psychology: The contextual emergence of mind and self* (pp. 88-110). New York, NY, US: Columbia University Press.

Marsh, H. W., Byrne, B. M., & Shavelson, R. J. (1988). A multifaceted academic self-concept: Its hierarchical structure and its relation to academic achievement. *Journal of educational psychology*, *80*(3), 366.

McCaslin, M. (2009). Co-regulation of student motivation and emergent identity. *Educational Psychologist*, *44*(2), 137-146.

McCaslin, M., Vega, R. I., Anderson, E. E., Calderon, C. N., & Labistre, A. M. (2011). Navigating and Negotiating in Small-Group Learning. *Sociocultural Theories of Learning and Motivation: Looking Back, Looking Forward*, *10*, 191.

Midgley, C., Kaplan, A., & Middleton, M. (2001). Performance-approach goals: Good for what, for whom, under what circumstances, and at what cost? *Journal of Educational Psychology, 93*(1) , 77-86.

Nasir, N. S., & Hand, V. (2008). From the court to the classroom: Opportunities for engagement, learning, and identity in basketball and classroom mathematics. *The Journal of the Learning Sciences, 17*(2), 143-179.

Nasir, N. S., & Saxe, G.B. (2003). Ethnic and academic identities: A cultural practice perspective on emerging tensions and their management in the lives of minority students. *Education Researcher, 32*(5), 14-18.

Nolen, S.B., Tierney, G., Becherer, K., Cooper, S., Eng, S., & Ward, C.J. (2012, April). *Engagement in what? Negotiation of joint enterprise in project-based learning*. Paper presented at the annual meeting of American Educational Research Association, Vancouver, BC.

Penuel, W. R., & Wertsch, J. V. (1995). Vygotsky and identity formation: A sociocultural approach. *Educational psychologist*, *30*(2), 83-92.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of educational psychology*, *82*(1), 33.

Poulin, F., & Pedersen, S. (2007). Developmental changes in gender composition of friendship networks in adolescent girls and boys. *Developmental psychology*, *43*(6), 1484.

Rich, Y., & Schachter, E. P. (2012). High school identity climate and student identity development. *Contemporary Educational Psychology*, *37*(3), 218-228.

Rogat, T.K. & Adams-Wiggins, K.R. (in press). Facilitative versus directive other-regulation in collaborative groups: Implications for socioemotional interactions. *Computers in Human Behavior.*

Rogat, T.K., & Adams-Wiggins, K.R. (2014). Other-regulation in collaborative groups: Implications for regulation quality. *Instructional Science,* 1-26.

Rogat, T.K. & Linnenbrink-Garcia, L. (2011) Socially shared regulation in collaborative groups: An analysis of the interplay between quality of social regulation and group processes. *Cognition and Instruction, 29*(4), 375-415.

Rogat, T.K., Linnenbrink-Garcia, L. & DiDonato, N. (2013). Motivation in collaborative groups. In Hmelo-Silver, C., Chinn, C., Chan, C. & O'Donnell, A. (Eds.), *International Handbook of Collaborative Learning.* Taylor & Francis, Inc.

Rogat, T. K., Witham, S. A., & Chinn, C. A. (2014). Teachers' autonomy relevant practices within an inquiry-based science curricular context: Extending the range of academically significant autonomy supportive practices. *Teachers College Record*, *116*(7), 1-46.

Roeser, R. W., Eccles, J. S., & Sameroff, A. J. (2000). School as a context of early adolescents' academic and social-emotional development: A summary of research findings. *The Elementary School Journal*, 443-471.

Roseth, C. J., Johnson, D. W., & Johnson, R. T. (2008). Promoting early adolescents' achievement and peer relationships: the effects of cooperative, competitive, and individualistic goal structures. *Psychological bulletin*, *134*(2), 223.

Ryan, A. M., & Patrick, H. (2001). The classroom social environment and changes in adolescents' motivation and engagement during middle school. *American Educational Research Journal*, *38*(2), 437-460.

Ryan, A. M. & Pintrich, P. R. (1997). "Should I ask for help?" the role of motivation and attitudes in adolescents' help seeking in math class. *Journal of Educational Psychology, 89*(2) , 329-341.

Roth, W.M., & Lee, Y. (2007). "Vygotsky's neglected legacy": Cultural-historical activity theory. *Review of Educational Research, 77*(2), 186-232.

Salonen, P., Vauras, M., & Efklides, A. (2005). Social interaction—What can it tell us about metacognition and coregulation in learning? *European Psychologist*, *10*, 199–208.

Schunk, D. H., & Pajares, F. (2005). Competence perceptions and academic functioning. In A. J. Elliot & C. S. Dweck (Eds.), Handbook of competence and motivation (pp. 85–104). New York: Guilford Press.

Strijbos, J. W., Kirschner, P. A., & Martens, R. L. (Eds.). (2004). What we know about CSCL: And implementing it in higher education. Boston, MA: Kluwer.

Strike, K. A. (2006). The ethics of educational research. In J. L. Green, G. Camilli & P. B. Elmore (Eds.), *Handbook of Complementary Methods in Education Research* (pp. 57-73). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers; US.

Sue, D. W. (Ed.). (2010). *Microaggressions and marginality: Manifestation, dynamics, and impact*. John Wiley & Sons.

Valencia, R. R. & Solórzano, D.G. (Eds.). (1997). *The evolution of deficit thinking: Educational thought and practice.* Bristol, PA: The Falmer Press.

Valencia, R. R., & Black, M. S. (2002). "Mexican Americans don't value education!"— On the basis of the myth, mythmaking, and debunking. *Journal of Latinos and Education, 1*(2), 81-103.

Vauras, M., Iiskala, T., Kajamies, A., Kinnunen, R., & Lehtinen, E. (2003). Shared-regulation and motivation of collaborating peers: A case analysis. *Psychologia*, 46, 19-37.

Volet, S., Vauras, M., & Salonen, P. (2009). Self- and social regulation in learning contexts: An integrative perspective. *Educational Psychologist*, *44*, 215–226.

Wang, M. T. (2009). School climate support for behavioral and psychological adjustment: Testing the mediating effect of social competence. *School Psychology Quarterly*, *24*(4), 240.

Wang, M. T., & Eccles, J. S. (2012). Social support matters: Longitudinal effects of social support on three dimensions of school engagement from middle to high school. *Child development*, *83*(3), 877-895.

Wang, M. T., Brinkworth, M., & Eccles, J. (2013). Moderating effects of teacher–student relationship in adolescent trajectories of emotional and behavioral adjustment. *Developmental psychology*, *49*(4), 690.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York, NY: Cambridge University Press.

Wertsch, J. V. (1998). Mind as action. New York: Oxford University Press.

Wigfield, A., Eccles, J. S., Mac Iver, D., Reuman, D. A., & Midgley, C. (1991). Transitions during early adolescence: Changes in children's domain-specific self-perceptions and general self-esteem across the transition to junior high school. *Developmental Psychology*, *27*(4), 552.

Wolters, C. (2004). Advancing achievement goal theory: Using goal structures and goal orientations to predict students' motivation, cognition, and achievement. *Journal of Educational Psychology, 96*(2*),* 236-250.

Wong, C. A., Eccles, J. S., & Sameroff, A. (2003). The influence of ethnic discrimination and ethnic identification on African American adolescents' school and socioemotional adjustment. *Journal of personality*, *71*(6), 1197-1232.

Wortham, S. (2004). From good student to outcast: The emergence of a classroom identity. *Ethos, 32*(2), 164-187.

Wortham, S., & Contreras, M. (2002). Struggling toward culturally relevant pedagogy in the Latino diaspora. *Journal of Latinos and Education*, *1*(2), 133-144.

Yonge, C., & Stables, A. (1998). 'I am It the Clown': Problematising the Distinction

Between 'Off Task' and 'On Task' Classroom Talk. *Language and*

Education, *12*(1), 55-70.