STUDENTS' PEER RELATIONSHIPS, SOCIAL AND ACADEMIC GOALS, AND ACADEMIC ACHIEVEMENT: A SOCIAL NETWORK ANALYSIS APPROACH

by

Kara A. Makara

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Education and Psychology)
in the University of Michigan
2013

Doctoral Committee:

Research Professor Stuart A. Karabenick, Chair
Associate Professor Kai S. Cortina
Associate Professor Barry J. Fishman
Associate Professor Allison M. Ryan
Research Professor Stephanie D. Teasley

ACKNOWLEDGEMENTS

This dissertation is centered on the idea that social networks matter. Examining my own relationships throughout this process, it is clear that completion of this dissertation would not have been possible without the incredible social network that surrounds me.

I would first like to thank my chair, Stuart Karabenick. You have gone above and beyond as an advisor. You guidance has shaped my research in many ways. I deeply appreciate your investment of time, energy, and resources into my intellectual development, and I credit you with improving my thinking, writing, and collaboration skills. Thank you for pushing me to continually improve as a scholar. Thank you to my committee; I have greatly benefitted from collaborating with each of you. Kai Cortina, you aided in my graduate school transition and I really enjoyed working with you. Stephanie Teasley, you welcomed me into your lab and have provided support for me in so many different ways. Barry Fishman, I have gained so much from your expertise and encouragement over the past few years. Lastly, Allison Ryan, it is an honor to have you on my committee since your research has contributed so much to my thinking.

This project would not have been possible without the following individuals: Stuart Karabenick, Rob Jagers, Sulura, Pat, the other incredible educators at the school site, and the students at the school. I am especially thankful to the project research assistants. Glen, you have been there since the beginning and the vast ways that you have helped me will not be forgotten. Pat, thank you for the countless hours you have spent

scanning surveys and preparing this data. Also thank you to Alex, Elaine, and Molly. Finally, I want to acknowledge the National Science Foundation and the Rackham School of Graduate Studies for recognizing the value of research and providing financial support in various ways that have benefitted this project.

My research has been greatly enriched through the conversations and feedback I have received from being part of a community of scholars. Thank you to the wonderful faculty and students of the Combined Program in Education and Psychology, as well as Janie and Marie, the heart of CPEP. Thank you to the CPEP Motivation lab, led by Stuart Karabenick. Your feedback was invaluable; thank you Fani, Colleen, Loren, Alanna, Nick, Ben, Amanda, Bridget, and lab manager Pam. Also thank you to the USE Lab and its former and current members, led by Stephanie Teasley. Thank you especially Stephanie and Steve Lonn for providing a forum to explore my different research ideas.

I would like to thank several students who have become dear friends; I could not have done this without all of you. I am tremendously grateful for Jane Rochmes, for being my friend and for your substantial personal and academic support my entire time here, Fani Lauermann, for your valued friendship and continually inspiring me to be a better researcher, and Gina Park, my dear friend and constant source of encouragement.

Finally, I want to acknowledge my dearest friends and family. My best friends, Annie and Katie, I am so appreciative of your never-ending friendship and encouragement during these past years. I am also very grateful for the support from my extended family and from the wonderful friends I have made here in Michigan.

Most of all, mom and dad, it is because of your love and encouragement that I strive each day to work hard and to achieve my goals. Thank you for everything you have

done, from teaching me not to compare myself to others, from spending countless hours on the phone with me, and for supporting me through both my accomplishments and my challenges. You have helped me in so many ways it would impossible to list them all here. And to my brother Zach, thank you so much for reminding me that my work has a greater purpose—to help in some small way to improve educational efforts to support students' development. Education should be about meeting students where they are and helping them move forward, not test scores and labels.

Lastly, I am tremendously grateful for the love and support of Keith. You have made so much of this journey possible. There are not enough words to express the love and appreciation that I have for you. Thank you for moving here and supporting me during my graduate studies, I will forever be grateful. Thank you for encouraging me when I was frustrated, making me laugh, giving me countless rides to and from my office, helping me when I had deadlines, doing more than your share of work at home, exploring the state of Michigan with me, sharing your interests with me, providing much needed balance to my life, and most of all, for always believing in me.

TABLE OF CONTENTS

LIST OF TABLES

Table

LIST OF FIGURES

Figure

LIST OF APPENDICES

Appendix

ABSTRACT

Both personal and contextual factors contribute to develop students' motivation and academic success. This dissertation focuses on one major contextual factor of schools: peer relationships. Despite considerable evidence that peer relationships matter for students' academic processes and outcomes, there is a need to understand the direction of influence, to bridge research on social motivation and outcomes with academic motivation and outcomes, and to conceptualize the influence of peer relationships appropriately, which in part relies upon methods for measuring peer influences. The dissertation was accordingly designed to assess how high school students' peer relationships interact with their academic motivation, social motivation, and academic achievement. Using the framework of Achievement Goal Theory, students' social and academic motivation were defined as the different orientations of students' academic and social goals—whether students are focusing on developing competence, demonstrating competence, or avoiding demonstrating incompetence in the academic and social domains of school. Social network analysis procedures are used to calculate several measures representing students' centrality within the overall high school peer social network as well as to identify which peers are directly connected to the student.

The study was conducted at a large U.S. Midwestern public high school. Students (n = 851) completed surveys at three time points: the beginning, middle, and end of the 2010-2011 school year. Survey measures included an assessment of students' peer social network connections, academic achievement goals, and social achievement goals. The

dissertation was partitioned into three broad research objectives: 1) to describe the dynamic nature of the high school peer social networks and students' academic and social motivation, 2) to understand the relationships and predictive influence among students' academic goals, social goals, peer network position, and academic achievement across the school year, and 3) to examine the impact of peers' academic goals, social goals, and academic achievement on students' own goals and achievement.

Students' academic goals, social goals, network position, and academic achievement changed across the school year, and there were several grade level, gender, and race differences. The study provided evidence that academic variables and social variables served as both predictors and outcomes, supporting the notion that these processes and outcomes are reciprocally influential. Students' social goals, specifically the goal to have high quality relationships with others, stood out as important for influencing positive changes in social network position and academic achievement across the school year as compared to academic goals. Academic achievement also emerged as an important predictor of change in students' academic goals, social goals, and social network position. Furthermore, changes in students' academic goals, social goals, and academic achievement were predicted by the levels of motivation and achievement of the peers with whom they regularly "hang out with" at school. Thus students' peers socialized their motivation and academic achievement. As a consequence of these multiple perspectives and the inclusion of both social and academic goals, the present study provided a comprehensive demonstration of the importance of peers for students' academic development. In sum, learning at school is a social endeavor. Future research and implications for educational practice are discussed.

CHAPTER 1

INTRODUCTION

Motivation has both immediate and far-reaching consequences for students' academic success. Students' motivation—the process of initiating, directing, and sustaining one's goals—drives their behaviors, cognitions, and emotions. Students with adaptive motivation toward learning and schoolwork have higher task persistence, effort, use of self-regulated learning strategies, and make adaptive achievement-related choices, leading to higher academic achievement and graduation rates (e.g., Ames, 1992; Deci & Ryan, 2000; Eccles & Wigfield, 2002; Elliot & Dweck, 1988; Hardre & Reeve, 2003; Hidi & Harackiewicz, 2000; Meece, Anderman, & Anderman, 2006; Pintrich, 2000; Urdan, 2004; Weiner, 1986). Frameworks of academic motivation such as achievement goal theory, expectancy value theory, and self-determination theory specify that personal and contextual factors interact to impact students' motivation. This dissertation focuses on one major contextual factor: high school students' peer relationships, which are especially salient during adolescence when students strive to fit in and look to their peers for support (Berndt, 1979; Larson & Richards, 1991; Wentzel, 1998).

Peer relationships can impact students' academic motivation and achievement both directly and indirectly (Wentzel & Caldewell, 1997) and are associated with numerous indicators of students' success in school. These include students' academic engagement (Kindermann, 1993; 2007), perceptions of competence (e.g., Altermatt & Pomerantz, 2003), liking and enjoyment of school (Boulton, Don, & Boulton, 2011;

Ryan, 2001), classroom participation (Buhs, Ladd, & Herald, 2006), school involvement (Kingery, Erdley, & Marshall, 2011), expectations and values for academic school subjects (Goodenow, 1993), sense of belonging (Faircloth & Hamm, 2011), academic effort (Molloy, Gest, & Rulison, 2011), academic help seeking (Ryan, Hicks, & Midgley, 1997; Karabenick & Newman, 2011), pro-social behavior (Wentzel, Barry, & Caldwell, 2004; Wentzel & Caldwell, 1997), empathy (Wolfer, Cortina, & Baumert, 2012), disruptive behavior at school (Berndt & Keefe, 1995), academic achievement (Altermatt & Pomerantz, 2005; Bellmore, 2011; Kingery et al., 2011; Rizzuto, LeDoux, & Hatala, 2009; Ryan, 2001; Wentzel & Caldwell, 1997), and high school completion (Ream & Rumberger, 2008; Véronneau, Vitaro, Pedersen, & Tremblay, 2008).

Problem Statement

Despite evidence that peer relationships matter for students' academic outcomes, three critical issues remain unresolved. First is the direction of influence. Whereas studies typically focus on how peers impact students, they often do not account for the dynamic nature of peer relationships, including how peer relationships may in turn be impacted by students' own social strivings and academic achievement, such as their social achievement goals (e.g., Ryan & Shim, 2008). Thus there is a need for research that examines both how peer relations predict and are predicted by students' academic and social motivation at school. This approach has implications for research designs, specifically the need for longitudinal, multi-wave research, which would allow for the inference of direction of causality among variables.

Second, some motivation-related studies focus only on academic motivation and academic outcomes while inferring some social processes, while others focus on social

motivations and social outcomes while inferring some academic processes. More research is needed to bring these two domains together to understand how both academic and social motivational processes interact, since both may be salient within the classroom setting and direct students' engagement. For example, some researchers suggest that students give higher priority to interpersonal goals than to their academic goals while at school (Covington, 2000). While academic motivation, social motivation, and students' peer relationships are each shown to be independently related to academic outcomes, there is a need to understand how these variables are related with each other and whether they interact to encourage students' success in school which would in turn have consequences for recommendations regarding comprehensive school interventions that focus on both academic and social aspects of schooling.

Third, there is a need to conceptualize the influence of peer relationships appropriately, which in part relies upon available methods for measuring peer influences. Many studies of the impact of peer relationships have relied upon self-report measures of students' perceptions of their peers or general perceptions of their school social environment, such as feelings of school belongingness and social support at school. Others measure students' social status, including sociometric variables such as popularity, peer acceptance, or peer rejection. Contemporary social network analysis (SNA) methods can map the intricately-patterned peer networks in schools in order to identify whom a student is connected to, to identify peer groups at school, or to identify students' location within their classroom or school network. Given these methodological options, there are many ways to conceptualize how peers may influence students. For example, social learning theory suggests that students adopt the beliefs and behaviors of

the peers with whom they identify (Bandura, 1986). At the same time, connections to peers provide students with access to peer social capital—the wide array of benefits one receives from their social structures (Coleman, 1988). Depending upon the level of students' connectedness in their school's social network, they may have different access to information, opportunities, and support, leading to differing levels of success at school. Therefore, students' position in the classroom or school network, as well as their direct connections to their peers, may relate to their academic and social motivation as well as their academic achievement. There is a need to understand the various ways in which SNA can be used to measure peer relationships and what information can be garnered from these different approaches.

Overview of the Study

The dissertation is accordingly designed to examine how high school students' peer relationships interact with their academic motivation, social motivation, and academic achievement. Using the framework of Achievement Goal Theory, students' social and academic motivation are defined as the different orientations of students' academic and social goals—whether students are focusing on developing competence, demonstrating competence, or avoiding demonstrating incompetence in the academic and social domains of school. Social network analysis procedures provide several measures representing students' centrality within the overall high school peer social network as well as to identify which peers are directly connected to the student.

The study was conducted at a large U.S. Midwestern public high school. Students (n = 851) completed surveys at three time points: the beginning, middle, and end of the 2010-2011 school year. Survey measures include an assessment of students' peer social

network connections, academic achievement goals, and social achievement goals. Achievement and demographic data was provided by the school district. The dissertation is partitioned into three broad research objectives: 1) to describe the dynamic nature of the high school peer social networks and students' academic and social motivation, 2) to understand the relationships and predictive influence among students' academic goals, social goals, peer network position, and academic achievement across the school year, and 3) to examine the impact of peers' academic goals, social goals, and academic achievement on students' own goals and achievement.

Significance of the Research

This dissertation contributes to the field of educational psychology by providing an important study that addresses some of the aforementioned methodological needs—longitudinal data, use of contemporary SNA methodology, including both academic and social motivations and outcomes, and using cross-lagged models to identify reciprocal influences of social and academic variables on one another. Given the need to better conceptualize how peer relationships can be characterized and their influence on students' motivation and achievement, a framework will be presented that helps to explain the various ways in which SNA can be used to understand the relationship between peer relationships and students' motivation and academic success in schools. Then the dissertation uses several of the approaches measuring both direct and indirect influences of peers on students' motivational processes in order to provide a comprehensive examination of how peers and motivations interact.

As a consequence, the study will lead to a better theoretical understanding of the peer network structure within high schools and therefore a better applied understanding

regarding how educators and researchers can intervene in schools to facilitate students' social and academic success during crucial stages of their adolescent development. As we begin to untangle the nature of peer relationships, we can improve our teaching methods in school, how we socially structure schools, and how we can intervene to encourage peers to have a positive impact on students. Educational interventions may be most effective if they focus on both academic and social elements of schools at one time rather than on one or the other. For example, curricular reform focused on improving students' adaptive motivation in the classroom may be most effective when also accounting for how to improve students' peer relationships. Consequently, the work will combine with existing research efforts to provide direction for how an important component of the school context, peer relationships, can be conceptualized in order to improve motivation and learning in schools.

Organization of the Dissertation

In order to address the purposes outlined above, this dissertation is separated into seven chapters. Chapter 2 presents the following: (a) a literature review of the goal theory approach to understanding students' academic and social motivation, (b) a review of adolescent students' peer relationships, (c) a methodological review of social network analysis, and (d) a framework for how social network analysis can be used to study the relationships between peer relationships and students' motivation and achievement. At the end of the chapter are the research objectives and hypotheses. Chapter 3 presents the research design, including a description of the sample, procedure, measures, and analytic methods used. Chapter 4 provides a description of the school, including images of the social network relations among peers at the school, means and standard deviations for all

of the variables, including how they differ by gender, race and grade level, analyses examining how the variables changes across the school year, and the correlations both within and across waves. Chapter 5 presents structural models of academic goals, social goals, students' network position, and academic achievement. The models show how the variables relate to one another as well as predict changes in one another across the school year. Chapter 6 is a presentation of the impact of peers' goals and achievement on students' own goals and achievement. The concluding Chapter 7 discusses implications of the results for theories regarding peer relationships and student motivation, applications for educational practice, limitations of the study, and directions for future work.

Chapter 1 References

Altermatt, E. R., & Pomerantz, E. M. (2003). The development of competence-related and motivational beliefs: An investigation of similarity and influence among friends. *Journal of Educational Psychology*, *95*(1), 111–123. doi:10.1037/0022-0663.95.1.111

Altermatt, E. R., & Pomerantz, E. M. (2005). The Implications of Having High-achieving Versus Low-achieving Friends: A Longitudinal Analysis. *Social Development*, *14*(1), 61–81. doi:10.1111/j.1467-9507.2005.00291.x

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology*, *84*(3), 261–271. doi:10.1037/0022-0663.84.3.261

Anderman, E., & Maehr, M. L. (1994). Motivation and schooling in the middle grades. *Review of Educational Research, 4,* 287-309.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. National Institutes of Mental Health. Englewood Cliffs, NJ: Prentice-Hall.

Bellmore, A. (2011). Peer rejection and unpopularity: Associations with GPAs across the transition to middle school. *Journal of Educational Psychology*, *103*(2), 282.

Berndt, T. J. (1979). Developmental changes in conformity to peers and parents. *Development Psychology, 15*(6), 608–616. doi: 10.1037/0012-1649.15.6.608

Berndt, T. J., & Keefe, K. (1995). Friends' influence on adolescents' adjustment to school. *Child Development*, *66*(5), 1312–1329. doi:10.2307/1131649

Boulton, M. J., Don, J., & Boulton, L. (2011). Predicting children's liking of school from their peer relationships. *Social Psychology of Education*, *14*(4), 489–501. doi:10.1007/s11218-011-9156-0

Buhs, E. S., Ladd, G. W., & Herald, S. L. (2006). Peer exclusion and victimization: Processes that mediate the relation between peer group rejection and children's classroom engagement and achievement? *Journal of Educational Psychology*, *98*(1), 1–13.

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, *94*, S95–S120. doi:10.2307/2780243

Covington, M. V. (2000). Goal theory, motivation, and school achievement: An integrative review. *Annual Review of Psychology*, *51*, 171–200. doi:10.1146/annurev.psych.51.1.171

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs

and the self-determination of behavior. *Psychological Inquiry*, *11*(4), 227–268. doi:10.1207/S15327965PLI1104_01

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology, 53,* 109–132. doi: 10.1146/annurev.psych.53.100901.135153

Elliot, E. S., & Dweck, C. S. (1988). Goals: An approach to motivation and achievement. *Journal of Personality and Social Psychology, 54*(1), 5–12. doi: 10.1037/0022-3514.54.1.5

Faircloth, B. S., & Hamm, J. V. (2011). The dynamic reality of adolescent peer networks and sense of belonging. *Merrill-Palmer Quarterly*, *57*(1), 48–72.

Goodenow, C. (1993). Classroom belonging among early adolescent students: Relationships to motivation and achievement. *The Journal of Early Adolescence*, *13*(1), 21–43. doi:10.1177/0272431693013001002

Hardre, P. L., & Reeve, J. (2003). A motivational model of rural students' intentions to persist in, versus drop out of, high school. *Journal of Educational Psychology*, *95*(2), 347–356. doi:10.1037/0022-0663.95.2.347

Hidi, S., & Harackiewicz, J. M. (2000). Motivating the academically unmotivated: A critical issue for the 21st century. *Review of Educational Research, 70*(2), 151–179.

Jacobs, J. E., Lanza, S., Osgood, D. W., Eccles, J. S., & Wigfield, A. (2002). Changes in children's self-competence and values: Gender and domain differences across grades one through twelve. *Child Development, 73*(2), 509–527. doi: 10.1111/1467-8624.00421

Karabenick, S. A., & Newman, R. S. (2011). *Help seeking in academic settings: Goals, groups, and contexts.* Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Kindermann, T. A. (1993). Natural peer groups as contexts for individual development: The case of children's motivation in school. *Developmental psychology*, *29*(6), 970.

Kindermann, T. A. (2007). Effects of naturally existing peer groups on changes in academic engagement in a cohort of sixth graders. *Child Development*, *78*(4), 1186–1203. doi:10.1111/j.1467-8624.2007.01060.x

Kingery, J. N., Erdley, C. A., & Marshall, K. C. (2011). Peer acceptance and friendship as predictors of early adolescents' adjustment across the middle school transition. *Merrill-Palmer Quarterly*, *57*(3), 215–243. doi:10.1353/mpq.2011.0012

Larson, R., & Richards, M. H. (1991). Daily companionship in late childhood and early adolescence: Changing developmental contexts. *Child Development, 62*(2), 284–300.

Meece, J. L., Anderman, E. M., & Anderman, L. H. (2006). Classroom goal structure, student motivation, and academic achievement. *Annual Review of Psychology, 57*, 487-503.

Molloy, L. E., Gest, S. D., & Rulison, K. L. (2011). Peer influences on academic motivation: Exploring multiple methods of assessing youths' most "influential" peer relationships. *The Journal of Early Adolescence*, *31*(1), 13–40. doi:10.1177/0272431610384487

Pintrich, P. R. (2000). An achievement goal theory perspective on issues in motivation terminology, theory, and research. *Contemporary Educational Psychology, 25*(1), 92-104.

Ream, R. K., & Rumberger, R. W. (2008). Student engagement, peer social capital, and school dropout among Mexican American and non-Latino White students. *Sociology of Education*, *81*(2), 109–139. doi:10.1177/003804070808100201

Rizzuto, T. E., LeDoux, J., & Hatala, J. P. (2009). It's not just what you know, it's who you know: Testing a model of the relative importance of social networks to academic performance. *Social Psychology of Education: An International Journal*, *12*(2), 175–189.

Ryan, A. M. (2001). The peer group as a context for the development of young adolescent motivation and achievement. *Child Development*, *72*(4), 1135–1150.

Ryan, A. M., Hicks, L., & Midgley, C. (1997). Social goals, academic goals, and avoiding seeking help in the classroom. *Journal of Early Adolescence*, *17*(2), 152–171.

Ryan, A. M., & Shim, S. S. (2008). An exploration of young adolescents' social achievement goals and social adjustment in middle school. *Journal of Educational Psychology*, *100*(3), 672–687. doi:10.1037/0022-0663.100.3.672

Urdan, T. (2004). Predictors of academic self-handicapping and achievement: Examining achievement goals, classroom goal structures, and culture. *Journal of Educational Psychology*, *96*(2), 251–264. doi:10.1037/0022-0663.96.2.251

Véronneau, M.-H., Vitaro, F., Pedersen, S., & Tremblay, R. E. (2008). Do peers contribute to the likelihood of secondary school graduation among disadvantaged boys? *Journal of Educational Psychology*, *100*(2), 429–442. doi:10.1037/0022-0663.100.2.429

Weiner, B. (1986). *An attributional theory of motivation and emotion.* New York, NY: Springer-Verlag.

Wentzel, K. R., Barry, C. M., & Caldwell, K. A. (2004). Friendships in middle school: Influences on motivation and school adjustment. *Journal of Educational Psychology*, *96*(2), 195–203. doi:10.1037/0022-0663.96.2.195

Wentzel, K. R., & Caldwell, K. (1997). Friendships, peer acceptance, and group membership: Relations to academic achievement in middle school. *Child Development*, *68*(6), 1198–1209. doi:10.2307/1132301

Wolfer, R., Cortina, K. S., & Baumert, J. (2012). Embeddedness and empathy: How the social network shapes adolescents' social understanding. *Journal of Adolescence, 35*, 1295-1305.

CHAPTER 2

LITERATURE REVIEW

The chapter begins with a theoretical review of achievement motivation, specifically students' academic goals and social goals and how these theories have developed over time. Second is a discussion regarding research and theory around peer relationships, specifically during adolescence, including why students form relationships, how these peer relationships can be characterized, individual differences in peer relationships, and research connecting peer relationships with students' success at school. Third is a description of social network analysis and an extensive methodological dialogue on relevant issues related to the use of SNA for examining peer relationships and motivation. Fourth is a presentation of a framework for understanding the ways that social network analysis can be used to study peers and motivation. The chapter concludes with research objectives and hypotheses.

Achievement Motivation

Academic Goals

Research across various frameworks of academic motivation has documented relations between students' adaptive motivation and school success. One motivation theory that has garnered a prolific amount of research attention is the Achievement Goal framework. The present research draws on this framework for understanding the reasons why students engage in adaptive and maladaptive behaviors that influence their success in school. Goal theory was developed in the 1970s and 1980s (e.g., Ames, 1984, 1992;

Dweck, 1986, Dweck & Legett, 1988; Elliot & Dweck, 1988; Maehr & Nicholls, 1980) as an alternative to the McClelland-Atkinson needs based approach (e.g., Atkinson, 1957). Achievement Goal Theory is based on the idea that how an individual defines competence shapes the particular goals that the he or she pursues in an achievement setting (Dweck, 1986; Elliot & McGregor, 2001), which then leads to a unique pattern of affective, cognitive, and behavioral outcomes (e.g., Covington, 2000; Elliot, Murayama, & Pekrun, 2011).

Originally, there were two goals in the Achievement Goal construct. Students that orient towards *mastery* goals are focused on developing their skills and therefore use a task- or self-based referent to evaluate their competence. For example, students with a mastery goal strive to achieve well academically because they want to develop their skills and learn the material. On the other hand, students oriented towards *performance* goals are focused on demonstrating their skills and therefore use an other-based referent to determine their competence. A student with a performance goal, for example, strives for achievement because they want to get a higher grade than others in the class. Theorists have used several terms to label these two goals, such as performance and learning goals (Elliot & Dweck, 1988), task and ego involvement goals (Nicholls, 1984), and demonstration and development goals (Ryan & Shim, 2008), although the terms *mastery* and *performance goals* (Ames, 1992; Elliot, 2005) are the most commonly used labels, which will be used here, and Achievement Goal Theory (AGT) for the general approach.

The following provides a historical view on how AGT has evolved over time. The initial view of AGT is that mastery goals lead to adaptive outcomes in classrooms and performance goals led to maladaptive outcomes in classrooms (see Ames, 1992). For

example, Nolen (1988) found that having a mastery goal was positively correlated with deep-level processing of learning materials, while having a performance goal orientation was correlated with less adaptive surface-level learning strategies. Meece, Blumenfeld and Hoyle (1988) found that mastery goals were positively correlated with active engagement such as self-regulated learning, connecting, monitoring, and help-seeking. In contrast, students that were performance oriented were linked to maladaptive behaviors. Furthermore, Elliot and Dweck (1988) found a relation between performance goals and numerous other maladaptive outcomes (e.g., learned helplessness, especially among those students with low perceived ability). However, as theorists continued to test the original two-dimensional model of AGT in a variety of settings, the pattern of findings for performance goals was sometimes mixed, revealing positive, null, or negative effects on important educational outcomes (Elliot, 2005). While some students with a performance orientation engaged in surface level processing, learned helplessness, or cheating, other students with a performance orientation were succeeding in their classes and getting higher grades than their mastery oriented peers (e.g., Barron & Harackiewicz, 2001; Elliot & McGregor, 2001; Harackiewicz, Barron, & Elliot, 1998).

To better account for the mixed pattern of findings for performance goals, a third goal was added to AGT that resulted in a three- dimensional model. Specifically, Elliot and Harackiewicz, (1996) noted an important distinction between approach forms of performance goal motivation and avoidance forms of performance goal motivation. This distinction takes into account valence, or whether individuals are aimed at approaching the positive possibility of competence or avoiding the negative possibility of incompetence (Elliot, 2005). It is suggested that both mastery and performance goals in

their original conceptualization were construed as approach goals (Elliot, Murayama, & Pekrun, 2011). Adding in the approach vs. avoidance dimension to performance goals, the theory came to include *performance-approach* goals, when an individual strives to do well compared to others, and *performance-avoidance* goals, when an individual strives to avoid doing poorly compared to others. This distinction has been empirically supported by several studies (e.g., Elliot & McGregor, 2001; Elliot, McGregor, & Gable, 1999). Furthermore, adding this distinction provided a clearer pattern of which achievement goals were consistently linked to particular adaptive and maladaptive outcomes. Specifically, mastery goals continued to be positively correlated with deep processing and performance-approach goal were positively correlated with exam performance. On the other hand, performance-avoidance goals were linked to being negatively correlated with deep processing and exam performance.

Recently, Achievement Goal Theory was once again revised to extend the avoidance and approach distinction to mastery goals (Elliot, 1999). Theorists suggested that if students can have either an approach or avoidance valence towards performance goals, then they could have this same approach to mastery goals (Pintrich, 2000). Students who adopt mastery-avoidant goals strive to achieve by not regressing on their knowledge or skills in the task at hand; in other words, to avoid developing incompetence. Therefore, a 2 x 2 (2-dimensional) model of achievement goals was theorized by crossing the definition of competence (mastery or performance) and valence (approach or avoidance). The 2 x 2 model is currently receiving the most research attention, especially in college student samples, and once again this distinction has been used to link achievement goals to a clearer pattern of adaptive and maladaptive outcomes.

Even more recently, theorists have considered a 2 x 3 model of achievement goals (Elliot, Murayama, & Pekrun, 2011) that takes into account the referent upon which the competence judgment is made, i.e., focusing on the self, on the task, or on others.

However, some have questioned the construct validity and explanatory power of splitting mastery goals into approach vs. avoidance, especially in research on younger populations. Mastery-avoidance goals are a theoretically more abstract concept and younger students may struggle with their comprehension, thus the three-goal framework is often used in survey research with younger middle school and secondary school populations. In order to be consistent with the dominant framework and base of empirical evidence, the present work adopts the three-goal framework of mastery, performance-approach, and performance-avoidance academic achievement goals. Students with a *mastery goal orientation* concentrate on developing their skills, understanding, and on personal improvement, students with a *performance-approach goal orientation* strive to demonstrate that they are doing well as compared to others, and students with a *performance-avoidance goal orientation* strive to avoid demonstrating that they are doing poorly compared to others (Elliot & McGregor, 2001).

Academic achievement goals are important for a range of adaptive learning outcomes. Hulleman, Schrager, Bodmann, and Harackiewicz (2010) reviewed 243 studies of achievement goals. Across studies, performance-approach and mastery-approach scales were moderately positively correlated with performance outcomes, while performance- and mastery-avoidance were negatively correlated with performance. Mastery-approach goals were highly positively correlated with interest, performance-approach was moderately correlated with interest, and performance- and mastery-

avoidance were slightly negatively correlated. Other meta-analyses have been conducted linking achievement goals with particular constructs. For example, Huang (2011) analyzed the relationship between achievement goals and achievement emotions—students' affect when performing a learning task. Mastery goals were strongly correlated with higher positive achievement emotions, performance-approach goals were not correlated with achievement emotions, and performance-avoidance goals were negatively correlated with achievement emotions. As another example, Rawsthorne and Elliot (1999) conducted a meta-analysis of experimental literature on achievement goals and intrinsic motivation and determined that pursuit of performance goals has an undermining effect on intrinsic motivation as compared to mastery goals.

In general, mastery goals are generally beneficial, performance-approach goals are beneficial for some students and harmful for others, and performance-avoidance goals are generally harmful. Students with a mastery goal orientation exhibit higher intrinsic motivation (e.g., Rawsthorne & Elliot, 1999), higher persistence, less procrastination, greater use of self-regulated, cognitive, and metacognitive learning strategies (e.g., Wolters, 2004; Elliot, McGgregor, & Gable, 1999; Vrugt & Oort, 2008), increased enjoyment and achievement (Daniels et al., 2009), and enjoyment of learning, hope, and pride (Pekrun, Elliot, &Maier, 2006). Performance goals, specifically approach goals, can be positive for some students (Barron & Harackiewicz, 2001; Harackiewicz, Barron, Tauer, Carter, & Elliot, 2000), but performance goals tend to be especially harmful for low achievers, promote surface level learning strategies and cheating, discourage help seeking, increase helplessness (Elliot and Dweck, 1988; Midgley, Kaplan, & Middleton, 2001), and increase anxiety while decreasing achievement (Daniels et al., 2009).

Performance-approach goals have both positive and negative outcomes; for example, they predict persistence and exam performance combined with surface learning strategies (Elliot et al., 1999), which may not be adaptive for long-term retention. Performance-avoidance goals are almost always harmful, since they predict anxiety, hopelessness, and shame (Pekrun et al.), surface processing, disorganized learning, and poor exam performance (Elliot et al., 1999). Pintrich (2000) found that mastery goals, either alone or combined with performance goals, were adaptive, whereas performance goals alone were maladaptive.

Regarding educational practice, a number of theorists call for a sole focus on mastery goals, known as the mastery goal perspective (Midgley, Kaplan, & Middleton, 2001). These researchers recommend that striving to encourage and promote only mastery goals will lead to the most adaptive student learning outcomes. For example, Midgley et al. (2001) argued that even though performance-approach goals are sometimes more facilitative for certain students, they also engender negative costs that mastery-approach goals do not such as cheating, reluctance to cooperate with peers, and engaging in superficial processes for learning. Another group of researchers suggests that there are benefits of adopting a multiple goal perspective in which both mastery-approach and performance-approach goals are pursued simultaneously (Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002; Harackiewicz, Barron, Tauer, Carter, & Elliot, 2000). It is noteworthy that the former research group typically drew their findings from adolescent samples while the latter research group typically drew their findings from college samples. Regardless of the perspective, researchers on both sides of the debate recognize that results are inconsistent in past literature, the role of moderating constructs

and consideration of individual difference matter, and research on a greater range of outcomes is needed to explain the inconsistencies of the effects of performance-approach goals. The present research contributes to this controversy by examining the associations among students' achievement goals, social network relations, and social achievement goals.

Social Goals

Although research on academic goals is much more extensive than research on social goals, motives in the social domain have been studied by social psychologists for quite some time. For example, Atkinson, Heyns and Veroff (1954) examined the motive for social affiliation (also termed need for affiliation) and suggested that individuals' anticipatory goal state regarding relationships with others could be conceived of as positive (approaching the possible benefits of relationships) or as negative (avoiding the costs associated with rejection or separation). As research on learned helplessness, academic motivation, and achievement goals started becoming more popular in the 1980s, researchers conjectured that students have similar orientations in the social realm as they do in the academic realm and called for an examination of the social achievement goal orientations (e.g., Dweck & Leggett, 1988; Blumenfeld, 1992). Since then, social goals have been conceptualized in multiple ways that have implications for the present context.

Rather than focusing on social motivations for engaging in social situations, one line of research on social goals remains within the academic goal realm by focusing on social reasons for engaging in academic work (Urdan & Maehr, 1995; Urdan, 1997), such as wanting to gain approval from parents or teachers. Similarly, McInerney, King, and

colleagues (Dowson & McInerney, 2003; King, McInerney, & Watkins, 2010; King & Watkins, 2012) define social goals as "the social reasons student espouse for wanting to achieve in academic situations" (Dowson & McInerney, p. 100). These researchers used qualitative methods to uncover affective and cognitive components of different types of social goals such as social responsibility, social status, and social concern. In a study on social affiliation and social concern goals, King et al. (2010) found that after controlling for the effects of academic mastery and performance goals, social concern positively predicted students' use of deep learning strategies, effort, and motivational engagement, whereas social affiliation goals were not related, although within the zero-order correlations they were positively correlated with effort and motivational engagement. The purpose of this approach to social goals largely draws from concern that the academic goal construct developed in Western cultures focus on individual goals, whereas in collectivist cultures, relational goals may be more prominent (King & Watkins, 2012).

A second line of social goal research (now within the social realm) focuses on the content of social goals. Wentzel (1989) focused of a range of students' goal content in the classroom and found that high school students' report of goals to be successful, dependable and responsible, understand things, do one's best, and get things done on time were positively related to GPA. Conversely, goals to earn approval and to make or keep friendships were not related to GPA, and goals to have fun were negatively related to GPA. Wentzel (1993) then examined students' goals for mastering subject matter, earning positive evaluations, being prosocial, and being compliant. Interestingly, students who tried to be both prosocial and compliant tended to earn higher grades, which was not true for students who reported only the pursuit of academic goals. Furthermore, students'

pursuit of academic prosocial goals positively related to peer acceptance, whereas academic responsibility goals negatively related to peer acceptance and positively to teacher acceptance (Wentzel, 1994). In turn, perceived academic support from peers positively predicted students' academic prosocial and social responsibility goals. In line with goal content research, Anderman and Anderman (1999) examined social responsibility, relationship (desire to form positive relationships with peers), and status goals (desire to gain popularity). Higher achieving students were more likely to endorse relationship and responsibility goals and less likely to endorse social goals. Furthermore, increases in task goal (*mastery*) orientation were associated with sense of school belonging and endorsing responsibility goals, whereas increases in ability goal (*performance*) orientation were associated with relationship and status goals, and negatively associated with school belonging.

The next line of research focuses on the approach vs. avoidance dimension of social goals, which is similar to approach vs. avoidance within academic achievement goal theory. Gable (2006) proposed and found support for a model in which distal needs for affiliation and fear of rejection lead to proximal approach and avoidance goals, which in turn lead to social outcomes (e.g., affiliation, intimacy, rejection, and conflict) and then to personal well-being and health. College students' approach goals led to decreased loneliness and higher satisfaction with social bonds, whereas avoidance led to higher anxiety about social bonds and decreased positive attitudes (Gable, 2006). Similarly, Elliot, Gable, and Mapes (2006) tested antecedents and consequences of social approach and avoidance goals among college students. Controlling for social desirability, friendship-approach goals positively predicted relationships satisfaction and the

frequency of positive relationship events, while friendship-avoidance goals positively predicted loneliness, the frequency of negative relationship events, and the impact of negative relationship events. Hope for affiliation predicted friendship-approach goals, which predicted increase in subjective well being. Fear of rejection predicted friendship-avoidance goals, which predicted an increase in negative physical symptoms. Using a similar approach to social goals, other researchers have found that friendship-approach goals positively predict instrumental help seeking while friendship-avoidance goals negatively predict instrumental help seeking (Roussel, Elliot, & Feltman, 2011).

A final line of social goal research reviewed here conceptualizes social goals along the same line as academic achievement goals. Ryan, Hicks and Midgley (1997) examined intimacy goals with a focus on forming and maintaining positive peer relationships (similar to *mastery* goals within the academic domain), and social status goals with a focus on social visibility and prestige among peers (similar to *performance goals* within the academic domain). Extending this, Ryan and Shim (2006, 2008) took into account both the approach and avoidance dimension as well as the mastery and performance dimension of social goals and created and validated scales to assess social goals that mirror the 3-dimensional Achievement Goal framework. Students' social goals can be oriented toward: 1) social development or *social mastery*, with a focus on developing friendships and having high quality friendships; 2) social demonstration-approach or *social performance-approach*, with a focus on demonstrating friendships by looking popular and comparing oneself to others; and 3) social demonstration-avoidance or *social performance-avoidance*, with a focus on avoiding the appearance of not having friendships by avoiding being made fun of or looking unpopular. These three social goals

effectively mirror the academic goals that were discussed earlier and will be used within this dissertation to conceptualize students' social motivation. Although Ryan uses the terms development and demonstration, the terms mastery and performance is used here for consistency across the academic and social goals as well as to differentiate the way social goals are measured here from the way that Ryan and colleagues currently measure social goals (details provided in Measures section of Chapter 3).

Research has demonstrated that these three social goal achievement orientations are associated with students' academic success in the classroom. Regarding antecedents of social goals, Shim et al. (2013) found that perceived classroom mastery goal structure positively predicted social development (i.e., mastery) goals and negatively predicted social demonstration-approach (i.e., performance-approach) goals, while perceived classroom performance goal structure positively predicted social demonstration-approach and avoidance (i.e., performance-approach and performance–avoidance) goals. More commonly studied are the consequences of social goals, with mastery social goals being the most beneficial. Across various studies, social development (i.e., social mastery) goals are associated with positive social relations, self-acceptance, personal growth, and social adjustment (Ryan & Shim, 2006), prosocial behavior and best friend quality (Ryan & Shim, 2008), positive relations with others and academic mastery goals (Horst et al., 2007), academic engagement and social satisfaction (Shim et al., 2013), belongingness and negatively with loneliness (Mouratidis & Sideridis, 2009), social competence (Shim & Ryan, 2012), and they moderate the relationship between interpersonal stress and depression (Kuroda & Sakurai, 2011). Similar to social mastery, intimacy goals are positively associated with task-focused and relative ability goals (Ryan et al., 1997).

Performance-oriented social goals are generally less adaptive. Social demonstration-approach (i.e., performance-approach) goals are negatively associated with personal growth and autonomy, and positively with social worry (Ryan & Shim, 2006), negatively related to prosocial behavior but positively related to aggressive behavior and perceived popularity (Ryan & Shim, 2008), positively related with academic performance-approach and performance-avoidance goals and with fear of negative evaluation and negatively related with positive relations with others (Horst et al., 2007), predict disruptive behaviors and social worry (Shim et al., 2013), and negatively predict peer acceptance (Mouratidis & Sideridis, 2009). A similar construct, social status goals, was related to higher avoidance of help seeking and threat associated with help seeking (Ryan et al., 1997). Social demonstration-avoidance (i.e., social performance-avoidance) goals are positively associated with academic performance-approach and –avoidance goals and with fear of negative evaluation, and negatively related with positive relations with others (Horst et al., 2007), positively associated with social worry (Ryan & Shim, 2006), negatively related to aggressive behavior and perceived popularity while positively related anxious solitary behavior and social worry (Ryan & Shim, 2008), predict high social worry but not disruptive behaviors (Shim et al., 2013), are negatively associated with social competence, popularity, and prosocial behavior and positively associated with anxiety and internalizing behavior (Shim & Ryan, 2012), and positively predict loneliness (Mouratidis & Sideridis, 2009).

Students may place just as much or even more emphasis on social goals as they do academic goals in the classroom setting (Covington, 2000). In Dowson and McInerney's (2003) study exploring students' goals in classroom settings, five out of the

eight goals that emerged from their exploratory analysis were social. Ryan and Shim (2006) measured both academic and social goals and found that the highest-rated goal out of all six was social mastery, followed by academic mastery. Similarly, Horst et al. (2007) had students rank academic and social achievement goals and the highest was social mastery, followed by academic mastery, and then academic and social performance-approach. In summary, social goals are relevant for students' motivations at schools, in some cases even more so than academic goals, and they relate to a range of social and academic processes and outcomes that impact students academic success. The 3-goal social achievement framework provides an important guide for understanding high school students' social motives. As stated by Ryan and Shim (2008), an achievement goal approach to social goals transcends the content of goals: "Regardless of whether people want intimacy or fun or both in a social situation, it is likely they also want to feel socially competent. Whether they are oriented to demonstrate their social competence, develop their social competence, or possibly to do both has implications for their beliefs and behavior" p. 673. Accordingly, this approach provides as a strong framework for understanding how students negotiate their position within the peer social network at school and in turn has implications for their academic achievement.

Peer Relationships in Adolescence

As stated in the introduction, a major component of the school context that impacts students' academic development is the influential system of peer relations within schools. This section reviews: 1) the antecedents of why students form peer relationships, 2) how peer relationships can be characterized, 3) individual differences in peer relationships, 4) psychological processes regarding how peer relationships impact

students and 5) why these peer relationships matter, specifically focusing on academic outcomes such as motivation and academic achievement.

The Formation of Peer Relationships

Peer relationships are salient during adolescence, a developmental stage when students strive to fit in and look to their peers for social support (Berndt, 1979; Larson & Richards, 1991; Wentzel, 1998). Particularly in Western societies, it is the norm for adolescents to spend more time with their peers while cutting back on time spent with their family. In the transition to middle school, children report more positive relationships with peers and less positive relationships with adults (Lynch & Cicchetti, 1997). By ages 16-18, students perceive that friend support exceeds both teacher and parent support (Bokhorst, Sumter, & Westenberg, 2010).

Contextual factors influence how peer social networks form in schools. One key initiator of network formation is geographical proximity (e.g., Festinger, Schacter, & Back, 1950). In schools, students who are in the same classes, who have lockers near each other, and who see each other frequently because they are in the same clubs are more likely to be friends. However, increasing use of the internet, cell phones, and other electronic forms of communication among adolescents (Willoughby, 2008) may change the relevance of geographical proximity in friendship formation. Organizational aspects of school, such as how students are organized for instruction, the existence of extracurricular activities, or grouping students by ability, will also affect the ways in which peer networks form. Grouping students by ability constrains the amount of possible interactions and can create groups that are homogeneous by ability levels (Hallinan & Sorensen, 1986). Even in schools without formal track systems, membership

in clusters emerge as a result of students taking similar classes together (Heck, Price, & Thomas, 2004). In Heck et al., group membership differed by demographics, academic achievement, and post-high school educational aspirations. Students who take most of their courses together or who are members of the same extracurricular activities are likely to interact more with each other, thus increasing the homogeneity of peer groups within the school.

School culture, such as school climate, teacher support, and peer support, also affects how networks form at school. Research demonstrates the importance of school culture and social climate on students' sense of belonging at school (e.g., Ma, 2003; Cemalcilar, 2010). Accordingly, students' perceptions of the school culture should relate to their network formation as well. For example, the amount of "exploration behavior" emphasized by each residence hall at a college predicted student social network structure within the hall (Perl & Trickett, 1988). If students go to a school where frequent interaction and collaboration are punished, where there is a focus on competition, or where they perceive that school is not an open and trusting place, it is likely that students will not have a very diverse or interconnected school network.

The Structure of Peer Relationships

When researchers study social influences on students in schools, they may study friendship dyads, peer groups, entire classrooms, they may look at where students are situated within the classroom or school network, or even compare social structures of entire schools. The simplest level of peer relationship is the friendship dyad. The definition of friendship is debated. Some researchers define dyadic relationships along a continuum, from best friend to worst enemy (e.g., Simpkins, Parke, Flyr, & Wild, 2006),

whereas others define a friend more generally as "someone whom a person knows and likes" (Berndt & McCandless, 2009, p. 64). Friendships can be important to study in and of themselves, separate from peer groups. A friendship dyad may be more influential than the group depending upon the variable being measured. For example, there is evidence that adolescent smoking is impacted by a best friend's smoking behaviors more so than by peer group behaviors (Unger & Rohrbach, 2002).

Peer groups consist of two or more students. "Collectives [of friends] become groups when social interaction among members occurs regularly; values are shared, beyond those common to every child or adolescent in the culture; members have a sense of belonging; and a structure exists that supports the norms that brought the members together in the first place" (Rubin, Bukowski, & Laursen, 2009, p. 13). Students can belong to one, none, or several peer groups, and some act as bridges between peer groups. Peer groups can be identified with social network analysis using mathematical algorithms based on the number of relations within a group versus between groups. As an alternative to peer groups, some researchers look at peer crowds, such as "jocks" or "nerds" (e.g., Brown, 1989).

Finally, peer relationships can be structured at a classroom or school level of analysis, which may be useful when observing learning outcomes specific to a classroom. Researchers may study relationships among all students within the classroom, or rank students according to their status. For example, Shen, Nuankhieo, Huang, Amelung and Laffey (2008) examined peer-peer and peer-teacher interactions within two online courses, and compared the two courses for students' average feelings of belongingness. Which way to structure peer relationships and thus what measures to use depends upon

the variables of interest and the context of the study. For example, students in U.S. elementary schools remain with their same peers throughout the entire day and therefore the classroom may be the best unit of analysis, whereas in U.S. high schools the entire school may be the preferred unit of analysis since students regularly switch classrooms throughout the school day.

Individual Differences in Peer Relationships

Social networks tend to be homogenous in terms of individual demographics, such as students' race, gender, or age. The phenomenon is not just a feature of student friendships within schools, but is a pervasive psychosocial feature of human relationships. Peer groups and peer dyads within the school tend to be similar across age (e.g., Ennet & Bauman, 1996), race (e.g., Hallinan & Teixiera, 1987; Hamm, 2000), and gender (e.g., Shrum, Cheek, & Hunter, 1988). Peer group homophily exists even in diverse settings, suggesting that desegregation is necessary but not sufficient for diverse interactions.

Peer groups also differ in structure based on student demographics. Gender differences in peer relationships can be distinguished by both the number of peers in their peer groups and by the quality of the relationships, with girls typically having more friends than do boys (Rose & Smith, 2009). Girls have more same-sex and more other-sex friends than boys do, and girls are more likely to describe their romantic relationships by talking about qualities of close friendships, such as self-disclosure (Feiring, 1999). Girls tend to interact with their friends in dyads or small groups and spend more time talking to friends (e.g., Blatchford, Baines, & Pellegrini, 2003), whereas boys tend to

interact with friends simultaneously in large groups (e.g., Rose & Asher, 2004) and engage in more competition (e.g., Mathur & Berndt, 2006).

Students of different races or ethnicities have also shown different patterns of peer group structure, and peers may serve different purposes. Within Hallinan and Teixiera's (1987) samples, black students listed an average of 5.7 best friends, whereas white students listed an average of 3.9 best friends. Hamm (2000) found that between any two European American or Asian American friends, academic orientations were moderately correlated, significantly more so than for African American adolescents. Students of different races or ethnicities may also be differentially impacted by the school climate in terms of friendship selection. Hallinan and Teixiera (1987) found that if there was more emphasis on mastery and learning in the class, White students chose Black peers as best friends, whereas classroom environment that focused on performance had no effect on Black friendship choice. Interracial friendship choices also differ by race. Finally, having racially diverse peer groups is differentially beneficial depending upon students' own race. African-American students' achievement increased when they were in more racially heterogeneous peer networks, whereas having racially heterogeneous peer groups negatively impacted Asian and Latino students' achievement (Goza & Ryabov, 2009).

Differences in peer networks across age are likely due to a combination of developmental stage differences and standard differences in the school context. In Feiring's (1999) study, students had moderate numbers of same-sex friends at age 9 (M = 7.7), the most friends at age 13 (M = 14.2), and fewer friends at age 18 (M = 5.5) (Feiring, 1999). Number of other-sex friends also grows substantially between 9 to 13 years of age, and then decreases at 18 years of age. Within the U.S., elementary, middle,

and high schools differ in number of students at the school, whether students remain with the same peers throughout all of their courses, and in other provisions for or constraints against peer interaction. For example, students in U.S. elementary schools may be more likely to interact with peers within their classrooms than peers not in their classrooms. By middle and then high school, each class contains different students, widening the number of potential student interactions.

How Peer Relationships Impact Students

Peer relationships impact students' academic motivation and achievement in both direct and indirect ways (Wentzel & Caldewell, 1997). Some of the many direct influences include processes such as socialization, conformity, comparison, co-regulation and collaborative learning (e.g., Volet, Summers, & Thurman, 2009). According to social learning theory (Bandura, 1986), students adopt the beliefs and behaviors of the peers with whom they identify and to whom they feel emotionally close. Through discussions, taking each other's perspectives, and resolving conflicts, interaction with peers help students to accommodate new and sometimes better ways of problem solving and thinking about the world (Piaget, 1956). Contemporary researchers in motivation tend to agree: "Exposure to peers' approaches to school and schoolwork provides an adolescent with options of how they might think about and engage in schoolwork themselves" (Ryan, 1998, p. 21). Social learning is also discussed within research on collaborative knowledge construction (e.g., Arvaja, Salovaara, Hakkinen, & Jarvela, 2007), based out of Vygotsky's research on cognitive development and the Zone of Proximal Development.

Indirect influences of peers on students include access to social and intellectual capital and feelings of belongingness or emotional distress, which in turn impact students' academic outcomes. For example, the convoy model (e.g., Kahn & Antonucci, 1980; Levitt, 2005) is an example of how some developmental psychologists have framed social relations, taking into account the importance of stable relationships over the lifespan (Levitt, 1991) and the importance of attachment for adaptive development (e.g., Antonucci, 1976). Specific to academic motivation, Martin and Dowson's (2009) review proposes that interpersonal relationships with others fulfill students' need for relatedness, teach students what motivations are needed to function effectively in educational environments, positively influence other self-processes relevant to motivation, and influence students' internalization of others' motivation.

The Consequences of Peer Relationships

Given the range of ways in which peers may impact students, it is not surprising that a substantial body of research has emerged documenting the many impacts of peers on students. Social network analysis as a tool for understanding peer impacts has been used most extensively in the context of peers' influence on adolescents' physical and mental health, including depression, underage drinking, smoking, eating behaviors, and in the creation of effective prevention programs for adolescents (e.g., Kiuru, Burk, Laursen, Nurmi, & Salmela-Aro, 2012; Cruz, Emery, & Turkheimer, 2012; Ennett et al., 2008; Mercken, Snijders, Steglich, & de Vries, 2009; Hutchinson & Rapee, 2007; Gest, Osgood, Feinberg, Bierman, & Moody, 2011).

Relevant to the present study, students' relationships with their peers are associated with indicators of students' success in school, including students' academic

engagement (Kindermann, 1993; Kindermann, 2007), perceptions of competence (e.g., Altermatt & Pomerantz, 2003), liking and enjoyment of school (Boulton, Don, & Boulton, 2011; Ryan, 2001), classroom participation (Buhs, Ladd, & Herald, 2006), school involvement (Kingery, Erdley, & Marshall, 2011) students' expectations and values for an academic school subject (Goodenow, 1993), sense of belonging (Faircloth & Hamm, 2011), academic effort (Molloy, Gest, & Rulison, 2011), academic help seeking (Nelson-Le Gall & Glor-Scheib, 1986), pro-social behavior (Wentzel, Barry, & Caldwell, 2004; Wentzel & Caldwell, 1997), empathy (Wolfer, Cortina, & Baumert, 2012), disruptive behavior at school (Berndt & Keefe, 1995), academic achievement (Altermatt & Pomerantz, 2005; Bellmore, 2011; Kingery et al., 2011; Rizzuto, LeDoux, & Hatala, 2009; Ryan, 2001; Wentzel & Caldwell, 1997), and high school completion (Ream & Rumberger, 2008; Véronneau, Vitaro, Pedersen, & Tremblay, 2008).

Educational psychologists are beginning to amass literature on how peer social networks affect and are influenced by motivation and academic achievement, including underlying psychological mechanisms that affect social network formation and change. Much support for this research is rooted in studies demonstrating that students' sense of belonging at school and their perceptions of peer support positively influences their academic motivation (e.g., Connell & Wellborn, 1991; Goodenow, 1993; Nelson & DeBacker, 2008; Wentzel, 1998). More specific to network position, examinations of status hierarchy demonstrate that a child's popularity at school is linked to educational success (Sabongui, Bukowski, & Newcomb, 1998) and that peer rejection leads to decreased classroom participation and school avoidance, which in turn decreases academic achievement (Buhs, Ladd, & Herald, 2006). Finally, SNA has provided

evidence that friendships and peer groups impact student motivation through the process of socialization. Among early adolescents, peer groups influence changes in students' intrinsic value for their schoolwork and achievement and have marginal effects on changes in students' expectancy for success in school, controlling for their past achievement, value, and expectations (Ryan, 2001). Similarly, students' peer group academic engagement predicts changes in their own engagement across time, controlling for the fact that children initially select peers with similar levels of academic engagement (Kindermann, 2007).

Using SNA to Examine Peer Relationships and Motivation

One powerful way to analyze and understand peer relationships and their impacts on students' motivation is through the use of SNA, defined as the collection and analysis of network data in order to describe a network and draw inferences about how social processes develop throughout the network. This section presents the background of SNA, followed by a discussion of the general research design decisions involved in conducting SNA. Afterwards, three major methodological issues that are related to studying the impact of peer social networks on students' motivation and academic achievement are identified and discussed.

Background of Social Network Analysis

A social network is the social structure or pattern of individuals who have ties to each other through some interdependence (e.g., friendship, influence, or interaction) or through having something in common. Social networks can be considered a gestalt, a superordinate structure that is independent of the individuals within them, having their own unique functions, purposes, and processes. However, social networks also rely on

and influence the individuals that they contain. SNA has emerged as an analytic tool for assessing these social networks. Although its use is not widespread within educational psychology, SNA has been used for decades to understand peer relationships within the context of schools (e.g., Cohen, 1977; Jennings, 1941; Moreno, 1953). Jacob Moreno is credited as the father of SNA and his application of the approach is arguably the most influential on modern social network research. In his book, *Who Shall Survive*, Moreno (1934) defines *socionomy* as the science concerned with the psychological interrelations of various individuals and groups. As shown in Figure 2.1, one of Moreno's studies explored friendships among students in a public elementary school. It was mainly descriptive in nature but nevertheless garnered a great deal of attention.

A historically famous social network study is Milgram's small world experiment (Travers & Milgram, 1969). Milgram sent letters from a number of random subjects to a target person across the United States, while tracking the number of intermediary individuals who were required to deliver the letter to the target. The average number of steps (paths) between individuals and the target individual was approximately six persons. In other words, there is an average of six degrees of separation between any two people across the U.S. Although there are methodological critiques (e.g., Schnettler, 2009), Milgram's study produced two notable findings: 1) there are not as many people between two random individuals as one might intuitively think, and 2) around half of the letters went through the same individual on route to the target person, signifying that there are distinctive people in networks who serve as important links, or connectors, between many other individuals.

Concomitant research in social psychology and group dynamics also had implications for the development of social network theory and analysis (e.g., Lewin, 1947; Heider, 1958). Lewin considered group behavior a function of conflicting social forces within a perceived environment, where the interactions within the group form a structure with properties that can be analyzed mathematically (Lewin, 1947). In the 1950s, Schutz developed his theory of interpersonal relations that suggests inclusion, control, and affection are dimensions necessary to understand how groups operate. Heider (1958) focused on social perception and attitudes, with the theory that humans seek balance by having mental thoughts and attitudes that are not in conflict with one another. He explored triads, a network of three individuals, and the various situations in which there is tension and how individuals must make choices and changes in their likes and dislikes in order to find balance. During the 1970s-80s, researchers focused on the role of social preferences and influence in networks (e.g., Peery, 1979). Recently, Albert-Laszlo Barabasi, Stephen Borgatti, Alan Daly, Scott Gest, Thomas Kindermann, and Barry Wellman view social networks as the context for understanding human development and behavior. Today, social networks are explored in fields of information, sociology, psychology, biology, business, education, and more.

Conducting Social Network Analysis

Rather than treating individuals as discrete units of analysis, SNA focuses on the structure of relationships and how that structure affects both individual and group outcomes. Individuals in networks are defined as *nodes* and the relationships between those individuals are defined as *edges*. Figure 2.2 presents a small social network demonstrating nodes (students) and edges (connections between students). The tenets of

social network analysis are well summarized by Freeman (2000); SNA is motivated by a structural intuition based on ties linking social actions, it is grounded in systematic empirical data, it draws heavily on graphic imagery, and it relies on the use of mathematical and/or computational models. Then an important series of decisions needed to conduct SNA are described: 1) defining the sample for data collection, 2) defining the relationships to measure, 3) collecting the data, and 4) picking an appropriate approach for analyzing the network.

Defining the Sample. The first step within SNA is to define the sample, which is not always straightforward. Do we allow peers to choose friends from only within their classroom, from their grade level, their school, or across their entire community? The choice of which level to measure depends upon the psychological or learning processes that one is studying. To measure the effect of a network on students' decision to go to college would require focusing not only on their peers in school, but also their family, teachers, neighbors, and friends in their extracurricular activities. When measuring classroom-level achievement goals, it may be best to limit the sample to peers within a classroom. Choosing whom to sample is also an important methodological question because of the need to gather as full a sample as possible when studying the network. The typical rule is that the more of the sample you can collect from, the more accurate representation of the entire network. Missing a critical few individuals can greatly reduce accuracy. However, there are various ways of collecting data (e.g., having a subset of students define all the relationships in the classroom vs. having students define their own relationships) that can help account for only choosing a random sample from a larger network.

Defining the Relationships. How to define and measure the relationships between students within a social network is a second crucial methodological decision. The first distinction is whether to consider only reciprocal or unilateral network nominations. Reciprocal ties require mutual nomination (e.g., A must nominate B and B must nominate A), whereas unilateral ties only require one person in a dyad to nominate the other. Researchers may miss out on a number of important possible influences by requiring ties to be reciprocated, although reciprocated ties may provide a more accurate picture of true friendships. A study of young adolescents' motivation and friendships suggests that influence is stronger when ties are reciprocated versus unilateral (Altermatt & Pomerantz, 2003).

Related is the decision of whether to allow edges to be directional. For example, if student A nominates student B as a friend but B does not nominate A, then the edge includes an arrow only pointing from A to B. Researchers may be able to study a range of interesting questions comparing individuals in which many links come inward as opposed to individuals in which many links go outwards. Specifically, students may nominate some peers who do not nominate them back, resulting in different "incoming" and "outgoing" ties. These different ways of defining peer relationships may reflect different underlying mechanisms, for example, the peers that students nominate (i.e., outgoing ties) reflect who students think they interact with, which might be important if researchers care about students' perceptions. However, the peers that state they hang out with the student (i.e., incoming ties) may provide a more objective measure of students' peer interactions. However, analyses involving directional ties are more complex and fewer software tools adequately account for this type of information.

Another methodological issue in defining the relationships within SNA is whether to allow edges to be weighted. Edges can be weighted by strength of friendship, rating on a scale, number of interactions, ordinal choice, and many more possibilities. For example, students can rate their friends on a 1-5 Likert scale for how much academic support they provide and the value is used as a weight. Unweighted ties are interpreted as having the same weight, thus all connections are assumed to be equal. This can be misleading depending upon the research aims or hypotheses. However, the majority of research in motivation treats all relationships as having equal weights, due to the complexity with collecting and analyzing weighted friendship data.

A final issue when defining relationships is whether to measure relationships between nodes or to collect bipartite network data. An example of a bipartite network is actors and films. In this bipartite network, instead of relationships, acting are connected to each other by appearing in the same film together (e.g., Six Degrees of Kevin Bacon). In motivation research, researchers may wish to create a bipartite network based on students and teachers, students and classes they take, or students and school activities. For example, students who are in the same extracurricular activities (e.g., marching band or football) would be connected in the network.

Collecting Data. Data can be collected in various ways, although typically self-report is used. How a researcher defines the relationship, as previously discussed, has implications regarding how to collect the SNA data. If a meaningful relationship in the social network is based on frequency of interaction, a researcher may prefer observational coding. There is also the issue of cognitive validity; students and researchers may interpret “friendship” or “peer group” in very different ways. Cognitive pre-testing and

piloting items can help ensure that subject and researcher interpretations are consistent. Another decision is that data can be collected from teachers or from the students. Pittinski and Carolan (2008) assessed the level of agreement between teacher perceptions and student reports on within-classroom friendships. There was similarity, but teachers had less reported reciprocal friendship ties than students. The level of agreement between teachers and students regarding the students' social networks varied across classes and slightly increased over time. Finally, collecting social network initiates privacy concerns, especially when collecting data from minors within schools. Additional measures need to be taken in order to guarantee confidentiality since identifiable information is typically provided. Penuel, Sussez, and Korbak (2006) provide interview findings regarding educators' concerns with collecting and sharing network data.

Analyzing the Network. The final step is to determine what approach to use for analyzing the network. SNA involves mathematical analysis of nodes and structural properties of nodes (e.g. students and student achievement), edges (e.g., the friendship between students), and the network itself (e.g., how central a student is within their classroom network). Network analysis begins by formulating a matrix of relationships from the data collected, often aided by the use of SNA software. These connections can also be viewed visually by looking at a sociogram, which is a picture of all the nodes and edges within a network (see Figure 2.2 for an example). After data is converted to matrices and vectors, researchers calculate structural properties of nodes.

One type of structural property to analyze nodes within SNA is network position, which includes the designation of students as hubs, connectors, or isolates within the network. Researchers may hypothesize that students who are hubs in the network have

more of a leadership role in motivation, and students who are isolated may have low academic or social motivation. Another set of node structural properties falls under the category of centrality, defined loosely as the "importance" of any one node. Some common centrality measures include degree, betweenness, and closeness (Jackson, 2008). Degree is the number of nodes to which a student is connected, and in a directed network, indegree are the number of edges coming in to the node of interest, and outdegree are the number of edges going out of the node of interest. Betweenness and closeness are measures of how broadly a node can reach other nodes within the network. Figure 2.2 sizes individual students within a network by their betweenness score as a way to visually demonstrate the concept. Betweenness is similar to social capital; if students are between many other students in the network, more information and resources will flow through them. Measures of centrality will be key indices in the work presented here.

Another option for data analysis is the identification of communities within the larger network. With an analysis of peer relationships, identifying peer groups would be a natural option. Identifying peer group membership may be simple if groups are very separate and visual, but typical peer groups have a great deal of overlap and require mathematical formulas for calculations. Sometimes, instead of distinct peer groups, networks contain a giant connected group that contains a majority of the entire network. Community finding techniques are used within SNA to identify subgroups. Kindermann (1993) summarized methods used to analyze social network matrices in order to identify communities, including weighted chi-square analyses, correlational analyses of relationship similarities, hierarchical cluster analyses in conjunction with multidimensional scaling, principal coordinate analysis, correspondence analysis, and the

binomial z test. One method, random walk, is based on the principle that short random walks will on average spend more time within communities that between.

Finally, network evolution, or how networks change over time, is exceptionally important for exploring motivational processes. These include the stability of network characteristics, which edges are added or broken, how edge or node values change, how peer groups change over time, and how students are influenced by their friends. Contemporary SNA methods are available for use in studying network dynamics, such as the stochastic actor-based model for network dynamics (Snijders et al., 2010), which permits the estimation of parameters of network change. The stochastic actor-based model posits that the probabilities of whom an individual connects with within the network is partly endogenously determined as a function of the current network structure and in part exogenously determined as a function of characteristics of the individuals themselves and of characteristics of a pair within the network.

Issues Related to Studying Motivation with SNA

Conceptual issues arise when SNA is use to study peer networks and motivation. The first is whether to take an egocentric approach that focuses on an individual's network or a sociocentric approach that focuses on all the specified relations within a defined network. Most studies of students' motivation and peer interactions have taken an egocentric approach by observing how immediate social influences impact the individual (e.g., Goodenow, 1993), where the student is the unit of analysis, and measurements focus on observing their connections outward to others in the network. While students are assumed to be interdependent rather than independent within the network, the focus is on independent outcomes. A sociocentric, or whole network approach, shifts the focus from

the attributes of individual students to the relations between the students. The students are still assumed to be interdependent rather than independent, but the variable of interest is now on interdependent outcomes. Each student's location and interactions in the network provide opportunities for, and constraints on, the other members' motivation and subsequent learning and behavior. For example, a sociocentric approach to studying student motivation and social network processes would be a focus on classroom networks and classroom outcomes.

A second conceptual issue involves socialization and selection. Students within the same peer groups or connected within a specific network tend to be similar across a range of psychosocial variables. This similarity among friends arises from two simultaneous forces: socialization and selection (Cohen, 1977). Socialization is the process whereby individuals integrate cultural norms and ideologies into their own cognition and behavior through interaction with others. Selection, on the other hand, is the process of individuals choosing friends based on similarity. Selection is complicated because connected peers may be highly similar on one dimension (e.g., sports ability) although different on other dimensions. Hamm (2000) found that adolescents choose to interact with peers who are compatible on some dimensions but not on all, which is likely due to their developmental and psychological needs: "In the context of identity development, adolescents may leave themselves room to negotiate views and explore values within the security of compatible relationships. Further, locating friends who are relatively similar yet not identical may satisfy the need to find commonality with others and at the same time establish a unique sense of self (Erickson, 1968)." (*p*. 217).

In general, selection accounts for a large part of naturally forming peer groups in situations where students have some choice regarding whom they interact with on a regular basis. Cohen (1977) discussed how the U.S. popular media tends to exaggerate the role of socialization, while the magnitude of peer influence on student behaviors is overestimated due to selection forces. Cohen found that group selection accounted for most of the homogeneity within high school social groups, pressures to conform accounted for only small contributions, and deviates leaving a group did not account for homogeneity. In a study focused more specifically on achievement motivation, young adolescent friends selected peers based on self-perceptions of competence, academic standards, importance of meeting standards, and preference for challenge, and friends were influential (socialized) in terms of attributions for success and the importance placed on meeting academic standards (Altermatt & Pomerantz, 2003).

One concern with research that tries to compare selection and socialization, however, is the assumption that their social networks will equally impact all students. Individuals may differ, however, in how strongly they are socialized by their peer group because of cultural, historical, or other individual differences (such as demographics). For example, individual differences in academic achievement acts as a buffer against the socialization of school burnout (Kiuru et al., 2008). A second important point is that longitudinal research designs are required to separate socialization and selection effects. Thus Ryan's (2001) study of adolescents' changes in motivation as a result of peer group membership controlled for selection and socialization simultaneously by using two time points: the fall and spring of a school year. In a perfect (research design) world, to

account for selection and socialization, data collection would begin in a situation where all individuals meet for the first time, prior to forming friendships.

A third conceptual issue in the network analysis of motivation is whether the social interaction is perceived or behavioral. Perceived networks are those based on self-report (e.g., a list of friends), while behavioral networks are based on other types of quantifiable information (e.g., the number of speaking interactions as rated by an observer). Ideally, research is needed that includes measures of both perceived and behavioral networks simultaneously. This is a challenge, as any observer attempting to measure interactions may also have their own biases in perception. Pittinski and Carolan (2008) assessed the level of agreement between teacher perceptions and student reports of within-classroom friendships and found that while there was some disagreement, teacher responses more closely matched student responses as the school year went on. Research in online learning environments can aid in the collection of behavioral networks, as "chats" between individuals can be tracked, qualitatively coded, and quantified. Perhaps perceived networks (e.g., self-reported friendships) are important for some motivational outcomes, and behavioral networks (e.g., hours of interaction) are important for others. This is an exciting area of study that has implications in cognitive psychology—do students' perceptions or peer relationships, objective relationships, or some combination of the two important for students' motivation?

A Conceptual Framework

Social network theory provides a new set of research tools for studying how the social context affects motivational processes within school contexts. Traditional methods explore group averages and how learning variables (e.g., motivation and achievement)

relate to one another, but little can be determined about the social nature of the classroom. Adding SNA makes it possible to explore how motivation impacts who students select as friends and their position in the network of a school, and in turn how their peers impact their motivation and achievement, both through direct measures such as socialization as well as indirectly by providing access to peer social capital. SNA has been used in many different ways, and it can be confusing to comprehend the possibilities without a larger framework. Therefore, I adapt Borgatti and Ofem's (2010) general methodological framework for social network research to guide a description of the ways that SNA can be applied to studying peer relationships in schools and the impact of peers on students' educational development.

As shown in Figure 2.3, I label the first level as the *individual-individual* level, which focuses on how characteristics of individuals impact whom they select as peers, and in turn how their peers socialize their characteristics. The individual-individual level may be used to study students' selection of friends (e.g., with whom they form and dissolve friendships) as well as how peers act as socializing agents. There has been some research in this area but not extensively in the educational psychology literature. SNA has primarily been used to identify peer connections and peer groups within schools or classrooms, and then to study how peer groups socialize their members. For example, Kindermann (1993; 2007) and Ryan (2001) found that students nested within peer groups become more similar to their peer groups' motivation and achievement over time, controlling for selection. Studies that fall into this area provide evidence that peers directly matter for student motivation while also highlighting the important phenomenon that much similarity is due to friendship selection (e.g., Cohen, 1977). While this research

area is vitally important there are some limitations of this approach. Research on peer groups cannot take into account students who are isolated in the peer network and do not belong to a peer group, and complex statistical methods are required to allow for overlapping peer groups. In practice, students can belong to one, none, or several peer groups, and some act as bridges between peer groups. Research on direct individual-to-individual connections may also fail to take into account the importance of indirect connections with a network.

The second focus of SNA research shown in Figure 2.3 is that of individuals within the entire social network: the *individual-network* level. Beyond looking at students' direct relationships with others, this level concerns how students' personal characteristics impact their position in the overall class or school social network and consequently how students' position in the network, or in other words their level of connection to their peers, impacts their outcomes. This has been accomplished by examining students' sociometric position, and more recently, by using SNA centrality measures to quantitatively define each student's level of "connectedness" within the social network. This level considers the number of peers with whom students are connected as well as how their connection to certain peers impacts their indirect connections to others in the network. One limitation to date regarding this level is the lack of research that connects the vast array of SNA centrality measures to psychological and social theories regarding motivation, learning, and achievement. Importantly, research at this level has not focused on social learning (i.e., socialization) but rather on social resources (e.g., access to information, connectedness with peers).

This type of research could be conceptualized as drawing from the theory of *social capital* to understand how students' position in the peer social network of the school relates to their motivation and achievement. Social capital, broadly defined, encompasses the wide array of benefits one receives from his or her social structures (Coleman, 1988). Peer social capital, more specifically, is the benefits and social resources students receive from their connectedness to their peers that can lead to outcomes such as academic success. Depending upon the level of students' connectedness, they may have different access to information, opportunities, and support systems, leading to differing levels of success at school. For example, immigrant students have greater educational achievement and attainment when supported by a high achieving peer social network (e.g., Ryabov, 2009) and students with greater peer social capital are less likely to drop out (Coleman, 1988). There are (at least) two types of peer social capital: 1) bonding social capital (e.g., Putnam, 2000) in which students that have dense and homogeneous social networks with their peers have greater access to internal social resources, and 2) bridging social capital (e.g., Granovetter, 1973), in which students that have more autonomy from a dense network and more links to multiple groups in the peer network have greater access to external social resources.

A strength of examining students' level of connectedness within an overall network as opposed to focusing solely on peer group membership is the inclusion of students who are both popular as well as those who do not belong to a peer group, which can expose the negative impact of peer rejection on student motivation and achievement. For example, Buhs, Ladd, and Herald (2006) found that elementary students' peer rejection, moderated by chronic peer exclusion, led to decreased classroom participation

and achievement, whereas peer rejection moderated by chronic peer abuse led to school avoidance. The *individual-network* level should also be valuable for understanding how students might impact their own peer networks, drawing from their social motivation.

As shown in Figure 2.3, the third level—*network-network*—examines characteristics of entire social networks and why particular structures form, and as a consequence, how different network structures influence group level outcomes. This is perhaps the least explored area of network analysis within educational psychology, likely due to challenges of collecting large datasets and comparing across classrooms or schools. One network phenomenon that has been documented is preferential attachment (Barabási & Albert, 1999). A student who is already well connected within a network is more likely to form a new friendship than a student who is not well connected, with the outcome that over time a social network should tend to become more disparate in terms of the number of connections per person. As an example of research on the consequences of particular network structures, Shen et al. (2008) used SNA to explore sense of community within two online learning environments in higher education. The course with greater overall peer-peer interaction also had higher overall feelings of belongingness. Educational psychology is a perfect domain for studying this type of research since it would be advantageous to uncover what educational interventions may serve to encourage the positive and adaptive formation of peer social networks within classrooms and schools and how classes/schools with different structures compare in terms of student academic outcomes.

All three levels just discussed have implications for students' psychological processes, and whether these processes are treated as antecedents or as consequences of

social networks. What level to use for framing a particular study depends upon the research questions and access to data. The present study is designed to advance research on academic achievement goals, social achievement goals, and educational outcomes by using SNA in three ways, described below.

Research Objectives

Review of the existing research has established that although peer relationships generally matter for students' academic processes and outcomes, studies often do not account for the dynamic nature of peer relationships, including how peer relationships may in turn be impacted by students' own social strivings and academic achievement. Furthermore, research bridging academic and social domains together is needed to understand how both academic and social motivational processes interact. Finally, there is a need to conceptualize the influence of peer relationships appropriately by taking advantage of the use of SNA and determining what information can be garnered from different approaches to modeling the impact of peer relationships on students' motivation and achievement.

The current study examines adolescent students within one large high school across one school year at three time points to understand the relationships between high school students' academic goals, social goals, position in the network of their school, peer levels of goals and achievement, and their own academic achievement. The study will measure students' academic goals, social goals, and peer connections via survey at three time points: the beginning, middle, and end of the school year. The objectives for the study are split into three main foci: 1) a description of the high school peer network and motivational dynamics, 2) cross-lagged models to determine the relationships

between and predictive influence of academic goals, social goals, network position, and academic achievement across the school year, and 3) the impact of peers' academic and social goals and academic achievement on students' own goals and achievement.

Several SNA centrality measures will be used to capture students' level of connectedness to their peers. Degree is considered a local measure since it takes into account how many direct connections students have to their peers (Zemljič & Hlebec, 2005). *Indegree* is the number of nominations received, in other words, the number of other students at school who stated that they regularly "hang out" with the student. *Outdegree* is the number of nominations given by the student, in other words, the number of peers that a student states they regularly "hang out" with at school. Both indegree and outdegree are specifically included in order to determine whether they differ in terms of which academic and social motivations predict, or are predicted by, each measure. *Betweenness* captures not only how many connections a student has directly to their peers, but how well connected the student is as part of the larger social network. This is considered a global measure since it takes into account both direct and indirect connections a student has to their peers (Zemljič & Hlebec, 2005). Betweenness is short for Freeman node betweenness (Jackson, 2010), which is the number of times a student occurs on a shortest path between all other pairs of students in the network. These measures will be described again in Chapter 3. The following are the research objectives and specific research questions for the study, followed by the hypotheses.

Research Objective 1. A Description of the High School Peer Network and Motivational Dynamics

The following research questions guide my consideration of the dynamics of the high school peer social network and students' motivation:

1a. What does the entire social network of the high school look like at a single point in time (i.e., each wave of data collection)?

1b. What are the average scores of students' academic goals, social goals, social network variables, and academic achievement at each wave?

1c. How do students' academic goals, social goals, social network variables, and academic achievement differ by gender, race, and grade level?

1d. What are the interrelationships of academic goals, social goals, social network variables, and academic achievement both within each wave and across waves?

1e. How do academic goals, social goals, social network variables, and academic achievement change across the school year?

Research Objective 2. Modeling the Influences of Academic Goals, Social Goals, Peer Network Position, and Academic Achievement

2a. How do students' academic goals (mastery, performance-approach, and performance-avoidance) and social goals (mastery, performance-approach, and performance-avoidance) predict changes in each other across the school year?

2b. How do the social network variables (measures of students' position in the peer social network), academic goals, and social goals predict changes in each other across the year?

2c. How do students' academic goals, social goals, network position, and academic achievement (i.e., GPA) predict changes in each other across the school year?

Research Objective 3. The Impact of Peers' Goals and Achievement on Students' Goals and Achievement

3a. How do peers' academic goals predict changes in students' academic goals?

3b. How do peers' social goals predict changes in students' social goals?

3c. How do peers' academic and social goals predict changes in students' GPA?

3d. How does peers' GPA predict changes in students' GPA?

3e. Are there any differences in the impact of peers based on students' own grade level, gender, or race?

Hypotheses

Hypothesized Change in Measures Over the Year

It is expected that academic goals should generally decrease across the school year. Past research on academic goals suggests that mastery, performance-approach, and performance-avoidance goals decrease across school years (e.g., Middleton, Kaplan, & Midgley, 2004) as well as decrease within one school year, as has been shown with 9th grade Finnish students (e.g., Tuominen-Soini, Salmela-Aro, & Miemivirta, 2011). Since the environment of the school theoretically influences both academic and social goals, it is predicted that social goals will also fluctuate, although the expected direction and amount of change over the school year is exploratory. Over the school year it is also expected that the four measures of social network position should increase, on average, as students get to know each other better from the beginning to the end of the school year.

Hypothesized Individual Differences

Regarding individual differences, it is hypothesized that there will be gender differences in academic and social goals. In general, males engage in more competition than females (e.g., Mathur & Berndt, 2006) and studies have found that males have high academic performance goal orientation than females (e.g., Friedel, Cortina, Turner, & Midgley, 2007), which leads me to hypothesize that males in the proposed study will be more likely to exhibit social and academic performance goals than females. It is also expected that there will be differences in the social network measures by gender. Several researchers who study social networks and gender find that girls have more same sex and more other sex friends than boys (e.g., Feiring, 1999), suggesting that girls should have higher centrality, on average, than boys.

Some racial difference in academic and social goals are also expected. Although all students in this study are within the U.S., there many be some cultural differences that play a role, especially for Asian students. According to Oyserman et al. (2002), the core assumption in Western individualism that individuals are independent from other another has many implications, including that: 1) one should maintain a positive sense of self and feel good about one's unique and distinctive personal attitudes, 2) open expression and attainment of one's personal goals are important for well-being and life satisfaction, 3) judgment and causal inference are oriented toward the person rather than the situation or social context, and finally 4) a degree of ambivalence toward relationships and group memberships. Thus students with Eastern collectivist influences may respond differently. Regarding students' network position variables, Hallinan and Teixiera (1987) found that

black students listed more "best friends" on average than white students, thus it can be expected that black students may high higher outdegree than white and Asian students.

Finally, minor grade level differences are also expected. Pintrich and Schunk (2002) suggest that by the time students are in high school they are concerned primarily about getting good grades and prefer short, easy tasks to lengthier ones, thus performance goals become increasingly prevalent as children progress through the second school grades. In terms of network measures, older students who have been at the school longer should have developed more stable friendships and may become more central overtime, thus older grades should have higher betweenness scores than younger grades.

Hypothesized Relationships Between Academic and Social Goals

Regarding correlations among the goals, it is expected that there will be positive intercorrelations among the academic and the social achievement goals, both within and across domains. Hulleman et al. (2010) examined goal-goal correlations in their meta-analysis of 243 achievement goal studies and found that performance-approach and performance-avoidance goals were correlated at $r = .40$, performance-approach and mastery goals were correlated at $r = .19$, and performance-avoidance and mastery goals were correlated at -.01. It is unknown how change in one goal relates to changes in another goal within the same domain (e.g., how change in academic mastery goals relates to change in academic performance goals, how change in social performance-avoidance relates to change in social performance-approach goals). Theoretically it is expected that mastery and performance goals will negatively predict each other over time, as will approach and avoidance goals, since they are on opposing dimensions. However, students

may hold multiple goals (e.g., Barron & Harackiewicz, 2001) which means their predictive influence over time could end up not being systematic.

There is surprisingly little known about how changes in academic goals relate to changes in social goals, and vice versa. One hypothesis is that the relationship is independent; in other words, students have goal orientations in the various domains of their life that are completely unrelated. A second hypothesis is that pursuit of social goals may lead to pursuit of academic goals, or vice versa. For example, one could pursue mastery social goals, which leads to feelings of belongingness within one's peer group, which in turn leads the student to focus more on academic mastery goals as well because they do not feel the need to compare or worry about their relative academic performance. A third hypothesis is that there may be overarching approaches to motivation (such as being a "mastery person") that leads to particular approaches in all domains of one's life. It is likely some combination of the second and third hypothesis, since academic and social achievement goals are often positively correlated with each other across the same goal, for example, social mastery with academic mastery, but also within the same domain, such as performance-approach with performance-avoidance (e.g., Horst, Finney, and Barron, 2007).

Hypothesized Relationships Between Goals and Network Position

Regarding the relationship between goals and social network position, it is expected that achievement goals, whether academic or social, should lead students to perceive and interact with their social environment at school in different ways. Both academic and social achievement goals may influence whom students choose to hang out with, how often and how many students they seek out for social interactions, and the

quality of their interactions with other students at school. Research demonstrates that social mastery goals are associated with positive social relations and belonginess (Ryan & Shim, 2006; Horst et al., 2007; Mouratidis & Sideridis, 2009). In terms of social network status, however, students with social mastery goals focus on the quality of their friendships and less on the quantity and relatively popularity, thus it is expected that there will be either no relation or a small positive association between social mastery goals and network position. While Ryan and Shim (2008) found that students' self-reported popularity was positively predicted by demonstration-approach goals (social performance-approach), Horst et al. (2007) found that positively relations with others was negatively correlated with social performance-approach goals, so it is unclear how performance-approach goals will relate to network position. However, it can be expected that students' outdegree, which is the number of peers they list, should be positively associated with performance-approach goals because students are actively trying to appear popular and become more connected. All network measures should be negatively related to social performance-avoidance goals.

Academic goals, however, should function somewhat differently than social goals. As postulated by Poortvliet and Darnon in their review of the interpersonal effects of achievement goals, "We conclude that mastery goals—striving to improve one's own performance—lead to investments in exchange relationships, endorsement of reciprocity norms, and active efforts to integrate different opinions. In contrast, performance goals—striving to outperform others—may result in rather maladaptive social behaviors" (*p* 325, 2010). In a similar fashion, it is predicted that academic mastery goals should therefore lead to high centrality in the peer social network, and academic performance-approach

and –avoidance goals should lead to a lower number of nominations each student receives and lower centrality in the peer social network of the school.

Academic and social goals may not only predict students' position in their school social network; the relationship between achievement goals and social network position should be cyclical. For example, perceived peer support, such as being valued by friends, was found to predict particular achievement goals (Nelson & Debacker, 2008). In a high school network, students on the periphery may become socially and academically anxious, leading them to adopt performance-avoidance academic and social goals. Having a supportive group of peers and feeling well connected at school may allow students to feel safe, leading them to focus on improving their relationships and their academic understanding, thus leading to the adoption of mastery academic and social goals. Finally, having a competitive group of peers or being on the outside of a popular peer group may lead students to focus on demonstrating their competence, leading to the adoption of performance-approach social and academic goals.

Hypothesized Relationships Between Goals, Network Position, and Academic Achievement

Regarding academic achievement, it is expected that academic goals, social goals, and social network measures will be important for academic achievement, since all have been shown to independently relate to academic achievement (e.g., Buhs, Ladd, and Herald, 2006; Daniels et al., 2009; Ortiz, Hoyos, & Lopez, 2004). While the reported relationships between academic goals and academic achievement is extensive, it is unclear to what degree social goals will be associated with GPA, since they may only be indirectly related to academic achievement. Wentzel and Caldwell (1997) found positive

associations between 6th grade peer relations and 8th grade GPA, but after controlling for prior 6th grade GPA and emotional characteristics, none of the 6th grade peer variables predicted later academic achievement. If they are associated, it is expected that social mastery will be positively associated with GPA since this type of goal leads to social competence, feelings of belongingess at school, and positive prosocial interactions among students, while performance-approach may be unrelated or even negatively related since students may spend more time focused on popularity rather than on schoolwork. Performance-avoidance social goals should be negatively related to GPA, albeit indirectly through non-measured variables such as emotional distress and disengagement in school.

Given the theory of peer social capital, it is thought that all of the network variables will be positively associated with GPA. There are important local (i.e., indegree and outdegree) and global (i.e. betweenness) effects from being well connected in an overall network, as students gain benefits from and are influenced by their friends, as well as their friends' friends and their friends' friends' friends (Christakis & Fowler, 2009). The exact direction of influence over time and the strength of the relationships will be exploratory within the full cross-lagged model, especially since the models will control for prior social goals, network position, and GPA when estimating the predictive influence of these variables on one another.

Hypothesized Relationships between Peers' Goals and GPA with Students' Goals and GPA

Studies have provided evidence that students' motivation and achievement can be predicted by the peers that they are directly connected to (e.g., Altermatt & Pomerantz,

2003; Kindermann, 2007; Ryan, 2001; Wentzel, Barry, & Caldwell, 2004), thus it is expected that students' academic goals, social goals, and GPA will be predicted by their peers' academic goals, social goals, and GPA, respectively. Furthermore, it is expected that peers' academic and social mastery goals will positively influence students' GPA, since peers with academic and social mastery goals should be more cooperative, help one another, and other adaptive social behaviors (Poortvliet & Darnon, 2010), thus benefiting the student who hangs out with them. The analyses will also separately examine 1) the average goals and GPA of the peers who nominate each student (incoming peers), and 2) the average goals and GPA of the peers who are directly nominated by each student (outgoing peers). It is exploratory regarding whether incoming or outgoing peer levels, or both, will predict students' goals and GPA.

Chapter 2 References

Altermatt, E. R., & Pomerantz, E. M. (2003). The development of competence-related and motivational beliefs: An investigation of similarity and influence among friends. *Journal of Educational Psychology*, *95*(1), 111–123. doi: 10.1037/0022-0663.95.1.111

Altermatt, E. R., & Pomerantz, E. M. (2005). The implications of having high-achieving versus low-achieving friends: A longitudinal analysis. *Social Development*, *14*(1), 61–81. doi:10.1111/j.1467-9507.2005.00291.x

Ames, C. (1984). Achievement attributions and self-instructions under competitive and individualistic goal structures. *Journal of Educational Psychology, 76*(3), 478–487. doi: 10.1037/0022-0663.76.3.478

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology*, *84*(3), 261–271. doi: 10.1037/0022-0663.84.3.261

Anderman, L. H., & Anderman, E. M. (1999). Social predictors of changes in students' achievement goal orientations. *Contemporary Educational Psychology*, *24*(1), 21–37. doi: 10.1006/ceps.1998.0978

Antonucci, T. (1976). Attachment: A life-span concept. *Human Development, 19*(3), 135–142.

Arvaja, M., Salovaara, H., Hakkinen, P., & Jarvela, S. (2007). Combining individual and group-level perspectives for studying collaborative knowledge construction in context. *Learning and Instruction, 17*(4), 448–459. doi: 10.1016/j.learninstruc.2007.04.003

Atkinson, J. W., Heyns, R. W., & Veroff, J. (1954). The effect of experimental arousal of the affiliation motive on thematic apperception. *The Journal of Abnormal and Social Psychology, 49*(3), 405–410. doi: 10.1037/h0053499

Atkinson, J. W. (1957). Motivational determinants of risk-taking behavior. *Psychological Review, 64*(6), 359–372. doi: 10.1037/h0043445

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. National Institutes of Mental Health. Englewood Cliffs, NJ: Prentice-Hall.

Barabási, A.-L., & Albert, R. (1999). Emergence of scaling in random networks. *Science*, *286*(5439), 509–512. doi:10.1126/science.286.5439.509

Barron, K. E., & Harackiewicz, J. M. (2001). Achievement goals and optimal motivation: Testing multiple goal models. *Journal of Personality and Social Psychology*, *80*(5), 706–722. doi: 10.1037//0022-3514.80.5.706

Bellmore, A. (2011). Peer rejection and unpopularity: Associations with GPAs across the transition to middle school. *Journal of Educational Psychology*, *103*(2), 282–295. doi: 10.1037/a0023312

Berndt, T. J. (1979). Developmental changes in conformity to peers and parents. *Development psychology, 15*(6), 608–616. doi: 10.1037/0012-1649.15.6.608

Berndt, T. J., & Keefe, K. (1995). Friends' influence on adolescents' adjustment to school. *Child Development*, *66*(5), 1312–1329. doi: 10.2307/1131649

Berndt, T. J., & McCandless, M. A. (2009). Methods for investigating children's relationships with friends. In Rubin, K. H., & Bukowski, W. M. [Eds.], *Handbook of peer interactions, relationships, and groups* (pp. 63–81). New York, NY: Guilford Press.

Blatchford, P., Baines, E., & Pellegrini, A. (2003). The social context of school playground games: Sex and ethnic differences, and changes over time after entry to junior school. *British Journal of Developmental Psychology, 21*(4), 481–505. doi: 10.1348/026151003322535183

Blumenfeld, P. C. (1992). Classroom learning and motivation: Clarifying and expanding goal theory. *Journal of Educational Psychology*, *84*(3), 272–281. doi: 10.1037/0022-0663.84.3.272

Bokhorst, C. L., Sumter, S. R., & Westenberg, P. M. (2010). Social support from parents, friends, classmates, and teachers in children and adolescents aged 9 to 18 years: Who is perceived as most supportive? *Social Development, 19*(2), 417–426. doi: 10.1111/j.1467-9507.2009.00540.x

Borgatti, S. P., & Ofem, B. (2010). Overview: Social network theory and analysis. In Daly, A. J. [Ed.], *The ties of change: Social network theory and application in education* (pp. 17–30). Cambridge, MA: Harvard University Press.

Boulton, M. J., Don, J., & Boulton, L. (2011). Predicting children's liking of school from their peer relationships. *Social Psychology of Education, 14*(4), 489–501. doi: 10.1007/s11218-011-9156-0

Brown, J. R. (1989). *The rational and the social.* London, UK: Routledge.

Buhs, E. S., Ladd, G. W., & Herald, S. L. (2006). Peer exclusion and victimization: Processes that mediate the relation between peer group rejection and children's classroom engagement and achievement? *Journal of Educational Psychology*, *98*(1), 1–13. doi: 10.1037/0022-0663.98.1.1

Cemalcilar, Z. (2010). Schools as socialization contexts: Understanding the impact of

school climate factors on students' sense of school belonging. *Applied Psychology, 59*(2), 243–272. doi: 10.1111/j.1464-0597.2009.00389.x

Christakis, N. A., & Fowler, J. H. (2009). *Connected: The surprising power of our social networks and how they shape our lives.* New York, NY: Little, Brown and Company.

Cohen, J. M. (1977). Sources of peer group homogeneity. *Sociology of Education*, *50*(4), 227–241. doi: 10.2307/2112497

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, *94*, S95–S120.

Connell, J. P., & Wellborn, J. G. (1991). Competence, autonomy, and relatedness: A motivational analysis of self-system processes. In M. R. Gunnar & L. A. Sroufe (Eds.) *Self processes and development* (pp. 43-77). Hillsdle, NJ: Lawrence Erlbaum.

Covington, M. V. (2000). Goal theory, motivation, and school achievement: An integrative review. *Annual Review of Psychology*, *51*, 171–200. doi: 10.1146/annurev.psych.51.1.171

Cruz, J. E., Emery, R. E., & Turkheimer, E. (2012). Peer network drinking predicts increased alcohol use from adolescence to early adulthood after controlling for genetic and shared environmental selection. *Developmental Psychology*, *48*(5), 1390–1402. doi: 10.1037/a0027515

Daniels, L. M., Stupnisky, R. H., Pekrun, R., Haynes, T. L., Perry, R. P., & Newall, N. E. (2009). A longitudinal analysis of achievement goals: From affective antecedents to emotional effects and achievement outcomes. *Journal of Educational Psychology, 101*(4), 948–963. doi: 10.1037/a0016096

Dowson, M., &McInerney, D. M. (2003). What do students say about their motivational goals?: Towards a more complex and dynamic perspective on student motivation. *Contemporary Educational Psychology*, *28*(1), 91–113.

Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist*, *41*(10), 1040–1048.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review*, *95*(2), 256–273.

Elliot, A. J. (1999). Approach and avoidance motivation and achievement goals. *Educational Psychologist, 34*(3), 169–189. doi: 10.1207/s15326985ep3403_3

Elliot, A. J. (2005). A conceptual history of the achievement goal construct. *Handbook of*

competence and motivation, 16, 52–72.

Elliot, A. J., & Dweck, C. S. (1988). Goals: An approach to achievement and motivation. *Journal of Personality and Social Psychology, 54*(1), 5–12.

Elliot, A. J., Gable, S. L., & Mapes, R. R. (2006). Approach and avoidance motivation in the social domain. *Personality and Social Psychology Bulletin*, *32*(3), 378–391. doi: 10.1177/0146167205282153

Elliot, A. J., & Harackiewicz, J. M. (1996). Approach and avoidance achievement goals and intrinsic motivation: A meditational analysis. *Journal of Personality and Social Psychology, 70*(3), 461–475.

Elliot, A. J., & McGregor, H. A. (2001). A 2 x 2 achievement goal framework. *Journal of Personality and Social Psychology*, *80*(3), 501–519.

Elliot, A. J., McGregor, H. A., & Gable, S. (1999). Achievement goals, study strategies, and exam performance: A meditational analysis. *Journal of Educational Psychology, 91*(3), 549–563.

Elliot, A. J., Murayama, K., & Pekrun, R. (2011). A 3 x 2 achievement goal model. *Journal of Educational Psychology, 103*(3), 632–648. doi: 10.1037/a0023952

Ennett, S. T., & Bauman, K. E. (1996). Adolescent social networks: School, demographic, and longitudinal considerations. *Journal of Adolescent Research, 11*(2), 194–215. doi: 10.1177/0743554896112003

Ennett, S. T., Faris, R., Hipp, J., Foshee, V. A., Bauman, K. E., Hussong, A., & Cai, L. (2008). Peer smoking, other peer attributes, and adolescent cigarette smoking: A social network analysis. *Prevention Science*, *9*(2), 88–98. doi: 10.1007/s11121-008-0087-8

Erikson, E. H. (1968). *Identity: Youth and crisis.* New York, NY: W. W. Norton & Company, Inc.

Faircloth, B. S., & Hamm, J. V. (2011). The dynamic reality of adolescent peer networks and sense of belonging. *Merrill-Palmer Quarterly, 57*(1), 48–72. doi: 10.1353/mpq.2011.0004

Feiring, C. (1999). Concepts of romance in 15-year-old adolescents. *Social Interactions in Adolescence and Promoting Positive Social Contributions of Youth, 6*(2), 75–95.

Festinger, L., Schachter, S., & Back, K. (1950). The spatial ecology of group formation In Festinger, L., Schacter, S., & Back, K. [Eds.], *Social pressure in informal groups* (pp. 33–60). Stanford, CA: Stanford University Press.

Freeman, L. C. (2000). Visualizing social networks: *Journal of Social Structure, 1*(1), 1–15.

Friedel, J. M., Cortina, K. S., Turner, J. C., & Midgley, C. (2007). Achievement goals, efficacy beliefs and coping strategies in mathematics: The roles of perceived parent and teacher goal emphases. *Contemporary Educational Psychology, 32*(3), 434–458. doi: 10.1016/j.cedpsych.2006.10.009

Gable, S. L. (2006).Approach and avoidance social motives and goals. *Journal of Personality*, *74*(1), 175–222. doi: 10.1111/j.1467-6494.2005.00373.x

Gest, S. D., Osgood, D. W., Feinberg, M. E., Bierman, K. L., & Moody, J. (2011). Strengthening prevention program theories and evaluations: Contributions from social network analysis. *Prevention Science, 12*(4), 349–360. doi: 10.1007/s11121-011-0229-2

Goodenow, C. (1993). Classroom belonging among early adolescent students: Relationships to motivation and achievement. *The Journal of Early Adolescence*, *13*(1), 21–43. doi: 10.1177/0272431693013001002

Goza, F., & Ryabov, I. (2009). Adolescents' educational outcomes: Racial and ethnic variations in peer network performance. *Journal of Youth and Adolescence, 38*(9), 1264–1279. doi: 10.1007/s10964-009-9418-8

Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology, 78*(6), 1360–1380.

Hallinan, M. T., & Sorensen, A. B. (1986). Student characteristics and assignment to ability groups: Two conceptual formulations. *The Sociological Quarterly, 27*(1), 1–13. doi: 10.1111/j.1533-8525.1986.tb00245.x

Hallinan, M. T., & Teixeira, R. A. (1987). Students' interracial friendships: Individual characteristics, structural effects, and racial differences. *American Journal of Education*, *95*(4), 563–583. doi: 10.1086/444326

Hamm, J. V. (2000). Do birds of a feather flock together? The variable bases for African American, Asian American, and European American adolescents' selection of similar friends. *Developmental Psychology, 36*(2), 209–219. doi: 10.1037//0012-1649.36.2.209

Harackiewicz, J. M., Barron, K. E., Pintrich, P. R., Elliot, A. J., & Thrash, T. M. (2002). Revision of achievement goal theory: Necessary and illuminating. *Journal of Educational Psychology*, *94*(3), 638–645. doi: 10.1037/0022-0663.94.3.638

Harackiewicz, J. M., Barron, K. E., & Elliot, A. J. (1998). Rethinking achievement goals:

When are they adaptive for college students and why? *Educational Psychologist, 33*(1), 1–21. doi: 10.1207/s15326985ep3301_1

Harackiewicz, J. M., Barron, K. E., Tauer, J. M., Carter, S. M., & Elliot, A. J. (2000). Short-term and long-term consequences of achievement goals: Predicting interest and performance over time. *Journal of Educational Psychology, 92*(2), 316–330. doi: 10.1037//0022-0663,92.2.316

Heck, R. H., Price, C. L., & Thomas, S. L. (2004). Tracks as emergent structures: A network analysis of student differentiation in a high school. *American Journal of Education, 110*(4), 321–353.

Heider, F. (1958). *The psychology of interpersonal relations.* New York, NY: Wiley.

Horst, J. S., Finney, S. J., & Barron, K. E. (2007). Moving beyond academic achievement goal measures: A study of social achievement goals. *Contemporary Educational Psychology*, *32*(4), 667–698. doi: 10.1016/j.cedpsych.2006.10.011

Huang, C. (2011). Achievement goals and achievement emotions: A meta-analysis. *Educational Psychology Review, 23*(3), 359–388. doi: 10.1007/s10648-011-9155-x

Hulleman, C. S., Schrager, S. M., Bodmann, S. M., & Harackiewicz, J. M. (2010). A meta-analytic review of achievement goal measures: Different labels for the same constructs or different constructs with similar labels? *Psychological Bulletin, 136*(3), 422–449. doi: 10.1037/a0018947

Hutchinson, D. M., & Rapee, R. M. (2007). Do friends share similar body image and eating problems? The role of social networks and peer influences in early adolescence. *Behavior Research and Therapy, 45,* 1557–1577.

Jackson, M. O. (2010). *Social and economic networks.* Princeton, NJ: Princeton University Press.

Jennings, S. A. (1941). The structure of the group ring of a p-group over a modular field. *Transactions of the American Mathematical Society, 50*(1), 175–185.

Kahn, R. L., & Antonucci, T. C. (1980). Convoys over the life course: Attachment, roles, and social support. *Life-span development and behavior, 3,* 253–286.

Kindermann, T. A. (1993). Natural peer groups as contexts for individual development: The case of children's motivation in school. *Developmental psychology*, *29*(6), 970–977. doi: 10.1037/0012-1649.29.6.970

Kindermann, T. A. (2007). Effects of naturally existing peer groups on changes in academic engagement in a cohort of sixth graders. *Child Development*, *78*(4),

1186–1203. doi: 10.1111/j.1467-8624.2007.01060.x

King, R. B., McInerney, D. M., & Watkins, D. A. (2010). Can social goals enrich our understanding of students' motivational goals? *Journal of Psychology in Chinese Societies*, *11*(2), 1–16.

King, R. B., & Watkins, D. A. (2012). "Socializing" achievement goal theory: The need for social goals. *Psychological Studies*, *57*(1), 112–116. doi: 10.1007/s12646-011-0140-8

Kingery, J. N., Erdley, C. A., & Marshall, K. C. (2011). Peer acceptance and friendship as predictors of early adolescents' adjustment across the middle school transition. *Merrill-Palmer Quarterly*, *57*(3), 215–243. doi: 10.1353/mpq.2011.0012

Kiuru, N., Burk, W. J., Laursen, B., Nurmi, J.-E., & Salmela-Aro, K. (2012). Is depression contagious? A test of alternative peer socialization mechanisms of depressive symptoms in adolescent peer networks. *Journal of Adolescent Health*, *50*(3), 250–255. doi: 10.1016/j.jadohealth.2011.06.013

Kuroda, Y., & Sakurai, S. (2011). Social goal orientations, interpersonal stress, and depressive symptoms among early adolescents in Japan: A test of the diathesis-stress model using the trichotomous framework of social goal orientations. *The Journal of Early Adolescence, 31*(2), 300–322. doi: 10.1177/0272431610363158

Larson, R., & Richards, M. H. (1991). Daily companionship in late childhood and early adolescence: Changing developmental contexts. *Child Development, 62*(2), 284–300.

Levitt, M. J. (1991). Attachment and close relationships: A life-span perspective. In Gewirtz, J. L., & Kurtines, W. M. [Eds.], *Intersections with attachment* (pp. 183–206). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Levitt, M. J. (2005). Social relations in childhood and adolescence: The convoy model perspective. *Human Development, 48*(1–2), 28–47. doi: 10.1159/000083214

Lewin, K. (1947). Frontiers in group dynamics II. Channels of group life; Social planning and action research. *Human Relations, 1*(2), 143–153. doi: 10.1177/001872674700100201

Lynch, M., & Cicchetti, D. (1997). Children's relationships with adults and peers: An examination of elementary and junior high school students. *Journal of School Psychology, 35*(1), 81–99. doi: 10.1016/S0022-4405(96)00031-3

Ma, X. (2003). Sense of belonging to school: Can schools make a difference? *The Journal of Educational Research, 96*(6), 340–349. doi: 10.1080/00220670309596617

Maehr, M. L., & Nicholls, J. G. (1980). Culture and achievement motivation: A second look. *Studies in Cross-Cultural Psychology, 3,* 221–267.

Martin, A. J., & Dowson, H. (2009). Interpersonal relationships, motivation, engagement, and achievement: Yields for theory, current issues, and educational practice. *Review of Educational Research, 79*(1), 327–365. doi: 10.3102/0034654308325583

Mathur, R., & Berndt, T. J. (2006). Relations of friends' activities to friendship quality. *The Journal of Early Adolescence, 26*(3), 365–388. doi: 10.1177/0272431606288553

Meece, J. L., Blumenfield, P. C., & Hoyle, R. H. (1988).Students' goal orientations and cognitive engagement in classroom activities. *Journal of Educational Psychology*, *80*(4), 514–523. doi: 10.1037/0022-0663.80.4.514

Mercken, L., Snijders, T. A. B., Steglich, C., & de Vries, H. (2009). Dynamics of adolescent friendship networks and smoking behavior: Social network analyses in six European countries. *Social Science & Medicine, 69*(10), 1506–1514. doi: 10.1016/j.socscimed.2009.08.003

Middleton, M. J., Kaplan, A., & Midgley, C. (2004). The change in middle school students' achievement goals in mathematics over time. *Social Psychology of Education, 7*(3)*,* 289–311. doi: 10.1023/B:SPOE.0000037484.86850.fa

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

Molloy, L. E., Gest, S. D., & Rulison, K. L. (2011). Peer influences on academic motivation: Exploring multiple methods of assessing youths' most "influential" peer relationships. *The Journal of Early Adolescence, 31*(1), 13–40. doi: 10.1177/0272431610384487

Moreno, J. L. (1953). *Who shall survive? Foundations of sociometry, group psychotherapy and sociodrama.* Beacon, NY: Beacon House.

Mouratidis, A. A., & Sideridis, G. D. (2009). On social achievement goals: Their relations with peer acceptance, classroom belongingness, and perceptions of loneliness. *The Journal of Experimental Education*, *77*(3), 285–308. doi: 10.3200/JEXE.77.3.285-308

Nelson, R. M., & DeBacker, T. K. (2008). Achievement motivation in adolescents: The role of peer climate and best friends. *The Journal of Experimental Education, 76*(2), 170–189. doi: 10.3200/JEXE.76.2.170-190

Nelson-Le Gall, S., & Glor-Scheib, S. (1986). Academic help-seeking and peer relations in school. *Contemporary Educational Psychology, 11*(2), 187–193. doi: 10.1016/0361-476X(86)90008-1

Nicholls, J. G. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological Review, 91*(3), 328-346.

Nolen, S. B. (1988). Reasons for studying: Motivational orientations and study strategies. *Cognition and Instruction, 5*(4), 269–287. doi: 10.1207/s1532690xci0504_2

Ortiz, M. G. R., Hoyos, J. R. C., & Lopez, M. G. R. (2004). The social networks of academic performance in a student context of poverty in Mexico. *Social Networks, 26*(2), 175–188. doi: 10.1016/j.socnet.2004.01.010

Oyserman, D., Coon, H. M., & Kemmelmeier, M. (2002). Rethinking individualism and collectivism: Evaluation of theoretical assumptions and meta-analyses. *Psychological Bulletin*, *128*(1), 3–72. doi: 10.1037/0033-2909.128.1.3

Peery, J. C. (1979). Popular, amiable, isolated, rejected: A reconceptualization of sociometric status in preschool children. *Child Development, 50*(4), 1231–1234.

Pekrun, R., Elliot, A. J., & Maier, M. A. (2006). Achievement goals and discrete achievement emotions: A theoretical model and prospective test. *Journal of Educational Psychology*, *98*(3), 583–597. doi:10.1037/0022-0663.98.3.583

Penuel, W. R., Sussex, W., Korbak, C., & Hoadley, C. (2006). Investigating the potential of using social network analysis in education evaluation. *American Journal of Education, 27*(4), 437–451. doi: 10.1177/1098214006294307

Perl, H. I., & Trickett, E. J. (1988). Social network formation of college freshman: Personal and environmental determinants. *American Journal of Community Psychology, 16*(2), 207–224. doi: 10.1007/BF00912523

Piaget, J. (1956). *The child's conception of space.* London, UK: Routledge.

Pintrich, P. R. (2000). An achievement goal theory perspective on issues in motivation terminology, theory, and research. *Contemporary Educational Psychology*, *25*(1), 92–104. doi: 10.1006/ceps.1999.1017

Pintrich, P. R., & Garcia, T. (1991). Student goal orientation and self-regulation in the college classroom. *Advances in motivation and achievement: Goals and self-regulatory processes, 7,* 371–402.

Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in education: Theory, research, and applications.* Upper Saddle River, NJ: Prentice Hall.

Pittinsky, M., & Carolan, B. V. (2008). Behavioral versus cognitive classroom friendship networks. *Social Psychology of Education, 11*(2), 133–147. doi: 10.1007/s11218-007-9046-7

Poortvliet, P. M., & Darnon, C. (2010). Toward a more social understanding of achievement goals: The interpersonal effects of mastery and performance goals. *Current Directions in Psychological Science, 19*(5), 324–328. doi: 10.1177/0963721410383246

Putnam, R. D. (2000). *Bowling alone: The collapse and revival of American community.* New York, NY: Simon & Schuster Paperbacks.

Rawsthorne, L. J., & Elliot, A. J. (1999). Achievement goals and intrinsic motivation: A meta-analytic review. *Personality and Social Psychology Review, 3*(4), 326–344. doi: 10.1207/s15327957pspr0304_3

Ream, R. K., & Rumberger, R. W. (2008). Student engagement, peer social capital, and school dropout among Mexican American and non-Latino White students. *Sociology of Education*, *81*(2), 109–139. doi: 10.1177/003804070808100201

Rizzuto, T. E., LeDoux, J., &Hatala, J. P. (2009). It's not just what you know, it's who you know: Testing a model of the relative importance of social networks to academic performance. *Social Psychology of Education: An International Journal*, *12*(2), 175–189. doi: 10.1007/s11218-008-9080-0

Rose, A. J., & Asher, S. R. (2004). Children's strategies and goals in response to help-giving and help-seeking tasks within a friendship. *Child Development, 75*(3), 749–763. doi: 10.1111/j.1467-8624.2004.00704.x

Rose, A. J., & Smith, R. L. (2009). Sex differences in peer relationships. In Rubin, K. H., Bukowski, W. M., & Laursen, B. P. [Eds.], *Handbook of peer interactions, relationships, and groups* (pp. 379–393). New York, NY: Guilford Press.

Roussel, P., Elliot, A. J., & Feltman, R. (2011). The influence of achievement goals and social goals on help-seeking from peers in an academic context. *Learning and Instruction*, *21*(3), 394–402. doi:10.1016/j.learninstruc.2010.05.003

Rubin, K. H., Bukowski, W. M., & Laursen, B. [Eds.]. (2011). *Handbook of peer interactions, relationships, and groups*. New York, NY: Guilford Press.

Ryabov, I. (2009). The role of peer social capital in educational assimilation of immigrant youths. *Sociological Inquiry, 79*(4), 453–480. doi: 10.1111/j.1475-682X.2009.00300.x

Ryan, A. M. (1998). *The development of achievement beliefs and behaviors during early adolescence: The role of the peer group and classroom contexts*. Doctoral

dissertation, University of Michigan, Ann Arbor, MI.

Ryan, A. M. (2001). The peer group as a context for the development of young adolescent motivation and achievement. *Child development*, *72*(4), 1135–1150.

Ryan, A. M., Hicks, L., & Midgley, C. (1997). Social goals, academic goals, and avoiding seeking help in the classroom. *Journal of Early Adolescence*, *17*(2), 152–171. doi: 10.1177/0272431697017002003

Ryan, A. M., & Shim, S. S. (2006). Social achievement goals: The nature and consequences of different orientations toward social competence. *Personality and Social Psychology Bulletin*, *32*(9), 1246–1263. doi: 10.1177/0146167206289345

Ryan, A. M., & Shim, S. S. (2008). An exploration of young adolescents' social achievement goals and social adjustment in middle school. *Journal of Educational Psychology*, *100*(3), 672–687. doi: 10.1037/0022-0663.100.3.672

Sabongui, A. G., Bukowski, W. M., & Newcomb, A. F. (1998). The peer ecology of popularity: The network embeddedness of a child's friend predicts the child's subsequent popularity. *New Directions for Child and Adolescent Development, 1998*(81)*,* 83–91. doi: 10.1002/cd.23219988106

Schnettler, S. (2009). A small world on feet of clay? A comparison of empirical small-world studies against best-practice criteria. *Social Networks, 31*(3), 179–189. doi: 10.1016/j.socnet.2008.12.005

Shen, D., Nuankhieo, P., Huang, X., Amelung, C., & Laffet, J. (2008). Using social network analysis to understand sense of community in an online learning environment. *Journal of Educational Computing Research, 39*(1), 17–36. doi: 10.2190/EC.39.1.b

Shim, S., Cho, Y., & Wang, C. (2013). Classroom goal structures, social achievement goals, and adjustment in middle school. *Learning and Instruction*, *23*, 69–77. doi: 10.1016/j.learninstruc.2012.05.008

Shim, S. S., & Ryan, A. M. (2012). What do students want socially when they arrive at college? Implications of social achievement goals for social behaviors and adjustment during the first semester of college. *Motivation and Emotion*, 1–12. doi: 10.1007/s11031-011-9272-3

Shrum, W., Cheek, Jr., N. H., & Hunter, S. M. (1988). Friendship in school: Gender and racial homophily. *Sociology of Education, 61*(4), 227–239.

Simpkins, S. D., Parke, R. D., Flyr, M. L., & Wild, M. N. (2006). Similarities in children's and early adolescents' perceptions of friendship qualities across development, gender, and friendship qualities. *The Journal of Early Adolescence,*

26(4), 491–508. doi: 10.1177/0272431606291941

Snidjers, T. A. B., van de Bunt, G. G., & Steglich, C. E. G. (2010). Introduction to stochastic actor-based models for network dynamics. *Social Networks, 32*(1), 44–60. doi: 10.1016/j.socnet.2009.02.004

Travers, J., & Milgram, S. (1969). An experimental study of the small world problem. *Sociometry, 32*(4), 425–443.

Tuominen-Soini, H., Salmela-Aro, K., & Niemivirta, M. (2011). Stability and change in achievement goal orientations: A person-centered approach. *Contemporary Educational Psychology, 36*(2), 82–100. doi: 10.1016/j.cedpsych.2010.08.002

Unger, J. B., & Rohrbach, L. A. (2002). Why do adolescents overestimate their peers' smoking prevalence? Correlates of prevalence estimates among California 8th-grade students. *Journal of Youth and Adolescence, 31*(2), 147–153. doi: 10.1023/A:1014074027415

Urdan, T. C. (1997). Examining the Relations among Early Adolescent Students' Goals and Friends' Orientation toward Effort and Achievement in School. *Contemporary Educational Psychology*, *22*(2), 165–191. doi: 10.1006/ceps.1997.0930

Urdan, T. C., &Maehr, M. L. (1995). Beyond a two-goal theory of motivation and achievement: A case for social goals. *Review of Educational Research*, *65*(3), 213–243. doi: 10.2307/1170683

Veronneau, M. H., Vitaro, F., Pedersen, S., & Tremblay, R. E. (2008). Do peers contribute to the likelihood of secondary school graduation among disadvantaged boys? *Journal of Educational Psychology, 100*(2), 429–442.

Volet, S., Summers, M., & Thurman, J. (2009). High-level co-regulation in collaborative learning: How does it emerge and how is it sustained? *Learning and Instruction, 19*(2), 128–143. doi: 10.1016/j.learninstruc.2008.03.001,

Vrugt, A., & Oort, F. J. (2008). Metacognition, achievement goals, study strategies and academic achievement: Pathways to achievement. *Metacognition and Learning, 3*(2), 123–146. doi: 10.1007/s11409-008-9022-4

Wentzel, K. R. (1989). Adolescent classroom goals, standards for performance, and academic achievement: An interactionist perspective. *Journal of Educational Psychology*, *81*(2), 131–142. doi: 10.1037/0022-0663.81.2.131

Wentzel, K. R. (1993). Motivation and achievement in early adolescence: The role of multiple classroom goals. *The Journal of Early Adolescence*, *13*(1), 4–20. doi: 10.1177/0272431693013001001

Wentzel, K. R. (1994). Relations of social goal pursuit to social acceptance, classroom behavior, and perceived social support. *Journal of Educational Psychology*, *86*(2), 173–182.

Wentzel, K. R. (1998). Social relationships and motivation in middle school: The role of parents, teachers, and peers. *Journal of Educational Psychology, 90*(2), 202–209.

Wentzel, K. R., Barrry, C. M., & Caldwell, K. A. (2004). Friendships in middle school: Influences on motivation and school adjustment. *Journal of Educational Psychology, 96*(2), 195–203.

Wentzel, K. R., & Caldwell, K. (1997). Friendships, peer acceptance, and group membership: Relations to academic achievement in middle school. *Child Development*, *68*(6), 1198–1209. doi: 10.2307/1132301

Willoughby, T. (2008). A short-term longitudinal study of Internet and computer game use by adolescent boys and girls: Prevalence, frequency of use, and psychosocial predictors. *Developmental Psychology, 44*(1), 195–204. doi: 10.1037/0012-1649.44.1.195

Wolfer, R., Cortina, K. S., & Baumert, J. (2012). Embeddedness and empathy: How the social network shapes adolescents' social understanding. *Journal of Adolescence, 35*, 1295-1305.

Wolters, C. A. (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. doi: 10.1037/0022-0663.96.2.236

Zemljič, B., &Hlebec, V. (2005). Reliability of measures of centrality and prominence. *Social Networks*, *27*(1), 73–88. doi: 10.1016/j.socnet.2004.11.010

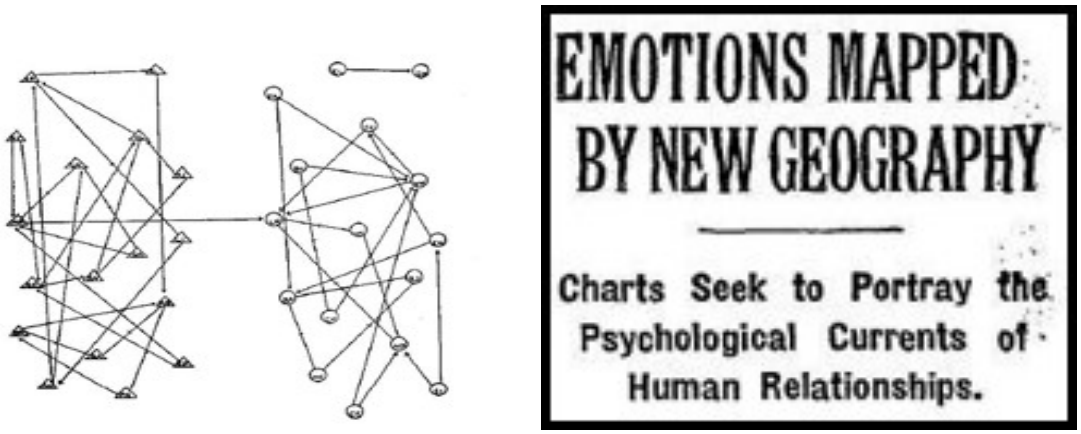


Figure 2.1 Moreno's study of social networks

Note. Image above on the left (Moreno, 1934) comes from Moreno's study on a fourth grade class. Original networks were hand-drawn. Triangles represent boys and circles represent girls. Image on the right is from a newspaper in the 1930's or 1940's discussing Moreno's work on sociometry.

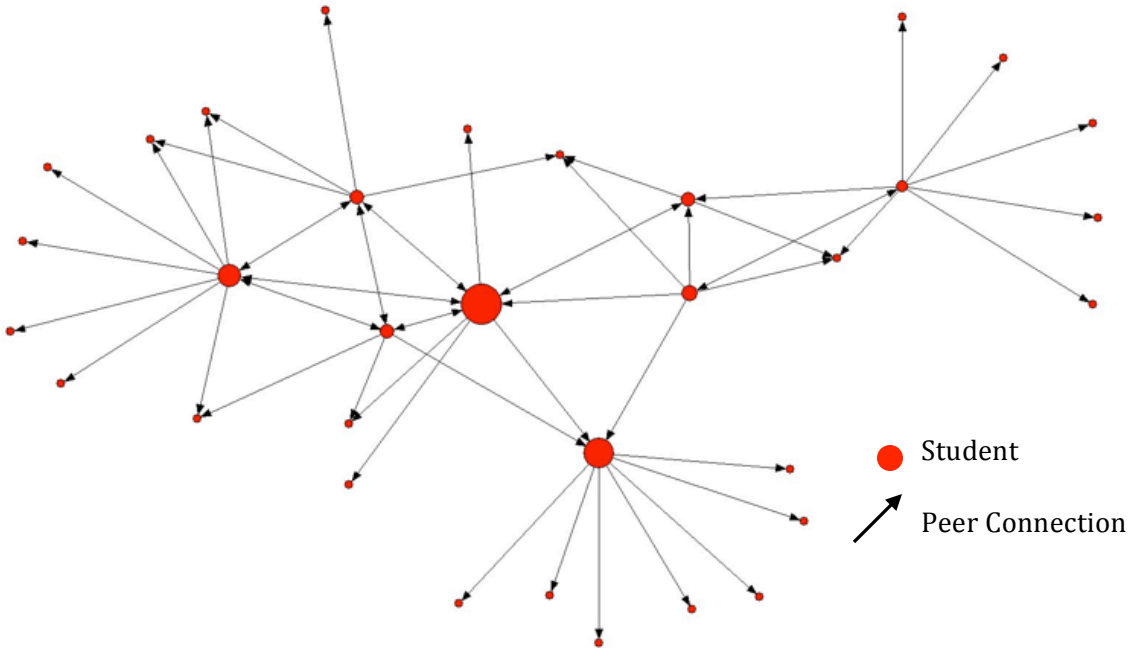


Figure 2.2 A small subset of the peer network.

Note. The nodes are sized by "betweenness". Betweenness is calculated as the fraction of shortest paths between all pairs of students in the network that pass through the target student. See Jackson (2010) for the mathematical definition.

	Antecedents of networks	Consequences of networks
Individual-Individual Level	**Type 1. Peer selection** Explains the formation and dissolution of ties between two individuals *E.g., Do students who have particular academic goals or values form friendships with peers who have similar goals?*	**Type 2. Peer socialization** Explains how connected individuals influence each other *E.g., Do students' friends and peer groups influence their motivation and achievement over time?*
Individual-Network Level	**Type 3. Peer network position** Explain how one's personal characteristics influence their structural properties and position in the network *E.g., Do students with particular social goals or achievement have higher numbers of friends?*	**Type 4. Peer social capital** Explains how one's structural properties influences an individual's outcomes *E.g., Do students who are more central or connected in the network have higher motivation and achievement?*
Network-Network Level	**Type 5. Peer network structuring** Explains characteristics of entire networks and why particular structures form *E.g., Do new students tend to become friends with the popular students, such that social disparities increase over time?*	**Type 6. Group social capital** Explains how different network structures influence group level outcomes *E.g., Do schools, classes, or peer groups that have greater cohesion among students have better social and academic outcomes?*

Figure 2.3. Methodological framework for using social network analysis to study peer relationships and academic outcomes

Note. Adapted from the "Methodological Framework for Network Research by Domain and Unit of Analysis" by Borgatti and Ofem (*p*. 22, 2010)

CHAPTER 3

METHOD

Procedure

The study was conducted at a large urban public high school in the Midwestern U.S. The high school added one new grade each subsequent year upon opening in 2008; thus during the 2010-2011 school year there were only 9th through 11th graders (n = 1,220). A working relationship with the school was established by assisting the school in various student survey evaluations and professional development. Pilot work conducted in May 2010 to test and improve upon the measures before surveying across an entire school year resulted in increasing the number of peers that students could list on the social network measure. On the pilot, students could list up to 7 peers and > 50% listed a full 7 peers, so on the preliminary study students could list up to 10 peers. IRB approval was obtained August 2010.

Data collection was conducted as part of a regularly-scheduled evaluation of students' perceptions of school climate at the high school. In order to use some of the survey data for research purposes, the entire high school student population was invited to participate. Students were given an assent form on the first two surveys and parental consent forms were collected during parent registration in the fall, and then were mailed home twice during the school year. Furthermore, letters were put in teacher mailboxes to inform them about the use of the some of the data for research purposes. Only those

surveys for which both student and parent written permission was obtained were assessed for this dissertation and for any other research dissemination purposes.

Surveys were distributed at the beginning of the school year in September 2010 (W1 = Wave 1), at the middle of the school year after winter break in January 2011 (W2 = Wave 2), and at the end of the school year in May 2011, approximately a month before summer vacation (W3 = Wave 3). Teachers distributed hardcopy surveys during homeroom periods, read instructions from a script, and had students place surveys in an envelope when completed in order to reinforce that student responses were confidential. During processing, student IDs replaced the names of peers that were collected for social network purposes. Subsequently, all identifying information was replaced with code numbers, and data was securely stored in accordance with IRB regulations. Aggregated data were shared regularly with the administration and teachers at the high school through reports and professional development presentations.

Participants

Across the year, student attendance fluctuated in the high school with some students entering and some leaving. District records show that there were 1,228 students at the school, although records used for collecting parent permissions along with district data suggests that there were only 1,184 students who were present at the school across all three semesters. Permission to use survey data for research purposes was received from both students and their parents for 853 participants. Two students for whom permission had been obtained did not have data available, resulting in a final sample size of 851 participants. The final sample was therefore 851/1,184, or 71.9% of the full school sample. Due to missing data from absences from school and/or not filling out surveys,

sample sizes at each wave were n = 759 at W1, n = 778 at W2, and n = 736 at W3. Among the 851 students, 35.4% were 9th graders, 33.4% were 10th graders, and 31.3% were 11th graders. 53.0% of the sample was female and 47.0% was male. The racial/ethnic composition of the sample was 12.5% Black, 10.8% Asian, 62.5% Caucasian, and 14.2% Other (included Multi-ethnic, Latino/Hispanic, Middle Eastern, Native American). The term "race" is used to denote the broad nature of these categories, rather than "ethnicity" which is more specific. Throughout the study Black or African-American students will be referred to as "Black"; White, Caucasian, or European-American students as "White"; and Asian students regardless of ethnic background as "Asian".

Publically available records on the 2010-2011 school demographics report the school racial composition as 56% European American, 18% African American, and 10% Asian, which suggests that the sample was slightly biased in having more European Americans and less African American students. The racial and gender structure of the sample is generally representative of a typical U.S. high school, which will be especially informative for determining patterns that likely exist for a broad range of students in U.S. public schools. Regarding grade level, district records show 33.0% in 9th grade, 35.2% in 10th grade, and 31.8% in 11th grade, which suggests my sample is representative of the school in terms of grade level. On a state standards-based test given in 2010-2011, 80% of the school population was at or above proficient in reading and 77% was at or above proficient in mathematics.

Measures

Academic Goals

Academic goals were measured with a 15-item Achievement Goal Orientation Scale that measures academic mastery, performance-approach, and performance-avoidance goals. The scale came from the Math Science Partnership – Motivation Assessment Program, which was a revision of the Patterns of Adaptive Learning Scales (Midgley et al., 2000). Items were edited slightly as appropriate to frame them for the school level rather than the classroom level. For example, the previous item "My goal is to do better than other students in mathematics" which was used to assess performance-approach in a mathematics classroom was edited to "My goal is to do better than other students." A list of the goal factors, reliabilities, inter-item correlations, and all items are provided in Table 3.1. A copy of the survey instrument is provided in the Appendix, A.1. Students responded to all items on a 5-point scale ranging from 1 (not at all true of me) to 5 (very true of me"). Reliabilities for mastery goals ranged from .85-.92, for performance-approach goals from .85-.90, and for performance-avoidance goals from .78-.86, which were all at an acceptable level.

A confirmatory factor analysis (CFA) reaffirmed the fit of the three-factor structure across the 15 items. As shown in Table 3.2, the three-factor structure at W1, W2, and W3 and the CFA indicated a good model fit at all waves, taking into account the various fit indices of CFI, TLI, RMSEA, and SRMR. These analyses were conducted using listwise deletion, thus the sample size varies based on number of participants at each wave. Standardized factor loadings ranged from .55-.80 at W1, .49-.81 at W2, and .61-.88 at W3. The mean of the items were therefore used to represent each factor. The latent factor correlations (which tend to be higher than Pearson correlation coefficients) between academic mastery, performance-approach, and performance-avoidance at W1,

W2, and W3 are shown in Table 3.3. These latent factor correlations are based on the standardized estimates when computing a model of the six factors (both academic and social) simultaneously. Among the academic goals, performance-approach and performance-avoidance were very highly correlated at W1 ($r = .82$, $p < .001$), at W2 ($r = .81$, $p < .001$) and at W3 ($r = .66$, $p < .001$).

Despite the high correlation between performance-approach and performance-avoidance, the three-factor structure had a better fit than a two-factor structure of mastery and performance with approach and avoidance items combined ($\Delta\chi^2 = 173.87$, $\Delta df = 2$, $p < .001$), suggesting that academic performance-approach and performance-avoidance are better represented as two unique constructs. Despite being theoretically distinct, the high positive correlation between performance-approach and performance-avoidance is common in research on achievement goals. A multi-method series of studies examining academic goals, similar to social goals, recommends the separation of performance-approach and performance–avoidance into distinct constructs (Murayama, Elliot, & Yamagata, 2011). Linnenbrink-Garcia et al. (2012) suggest that the strength of the positive correlation between performance-approach and performance–avoidance goals does not vary based on theoretically relevant moderators and that refined measures of performance goals would likely strengthen rather than weaken the correlation. These authors recommend that researchers may want to explore potential differences depending upon whether one or both goal orientations are included in regression analyses and to be aware of possible statistical suppression, which was considered here.

Social Motivation

Social motivation was measured with a 13-item Social Achievement Goal Orientation Scale (SAGOS; Ryan & Hopkins, 2003 as cited in Horst, Finney, & Barron, 2007). The scale is a reduced version of the original 22-item SAGOS and measures social mastery, social performance-approach, and social performance-avoidance goals. The reduced version of the SAGOS was validated among college students (Horst, Finney, & Barron, 2007) and the longer version was validated with both middle school students and a separate sample of college students (Hopkins & Ryan, 2000 as cited in Horst et at.). The authors have since updated the scale (e.g., Ryan & Shin, 2006), but the previous version is considered preferable for this study since it is theoretically aligned more closely with academic achievement goals. Items were edited to include the phrase "at this school" in order to measure their social motivation for peer relationships within the high school, to be consistent with the social network data which measures friendships within the high school. An example mastery social goal item is "It's important to me to have friends at this school who really understand me." A list of the goal factors, reliabilities, inter-item correlations, and items for each factor are provided in Table 3.1. A copy of the survey instrument is provided in the Appendix, A.2. Students responded to all items on a 5-point scale ranging from 1 "not at all true of me" to 5 "very true of me." Reliabilities for social mastery goals ranged from .87-.90, for performance-approach goals ranged from .82-.87, and for performance-avoidance goals ranged from .74-.81, which were all at an acceptable level.

A confirmatory factor analysis (CFA) reaffirmed the fit of the three-factor structure across the 13 items. As shown in Table 3.2, the fit of the three-factor structure was estimated at W1, W2, and W3 and the CFA indicated a good model fit at all waves,

taking into account the various fit indices of CFI, TLI, RMSEA, and SRMR. These analyses were conducted using listwise deletion, thus the sample size varies based on amount of participant at each wave. Standardized factor loadings ranged from .53-.84 at W1, .55-.87 at W2, and .62-.91 at W3. The mean of the items were subsequently used to represent each factor. The latent factor correlations between social mastery, performance-approach, and performance-avoidance at W1, W2, and W3 are shown in Table 3.3. These latent factor correlations are based on the standardized estimates when running a model of the six factors (both academic and social) simultaneously. Among the social goals, performance-approach and performance-avoidance were very highly correlated at W1 ($r = .69$, $p < .001$), W2 ($r = .70$, $p < .001$) and W3 ($r = .70$, $p < .001$).

Despite the high correlation between performance-approach and –avoidance, the three-factor structure had a better fit than a two-factor structure of mastery and performance with approach and avoidance items combined ($\Delta\chi^2 = 197.65$, $\Delta df = 2$, $p < .001$), suggesting that social performance-approach and performance–avoidance are better represented as two unique constructs. As previously argued under academic goals, the 3-factor social goal structure will be used and any suspected suppression effects will be reported.

Peer Social Network Position

Students were given instructions to "Please list the students at [name of school] that you hang out with the most, in no particular order. You do not have to fill in all the blanks. These names will not be seen by anyone at your school." These instructions were revised based on piloting. For example, on the pilot survey students were given blanks to fill in with numbers next to them, and a few students commented that they did not want to

"rank" their friends. Therefore in the survey for the study numbers and replaced with right chevrons, and "in no particular order" was added to the instructions. Under the instructions there were ten blanks to fill in, with directions to print both first and last name. A copy of the survey instrument is provided in the Appendix, A.3. The instructions are adapted from several studies, but notably the words "hang out" come from Ryan's (2001) network analysis with adolescent students. The study measured social ties across the entire school rather than within classrooms, allowing for a more appropriate observation of natural friendships in the high school setting (Kindermann & Gest, 2009).

Measures of a students' position in the peer social network of the school are somewhat unique to the field of educational psychology, so a description of each of the following network position variables will be described: indegree, outdegree, in2step, out2step, and betweenness. These variables were calculated via UCInet SNA software using the peer network data collected from students. The names of peer nominations were transformed into a matrix, which is then used to create sociograms and to calculate various social network variables.

As reviewed above, degree is the number of connections a student has to others in the network; *indegree* is the number of connections coming into a student in a directed network, and outdegree is the number of connections going out from a student in a directed network. If a student were to nominate many other students as friends in a network, but receive no nominations herself, then she would have high outdegree and zero indegree. In2step extends indegree out one more link, and thus represents the number of peers connected to the target student through their received nominations. In other words, if a student was nominated by 2 students, and each of those students was

connected to 4 students, that student would have an in2step of 8. Out2step, then, represents the number of peers connected to the target student through their direct nominations of others. In2step and out2step are therefore like a measure of the number of friends-of-friends that each student has. Betweenness is essentially a measure of how broadly a student is tied to all other students in the peer social network. Betweenness is defined mathematically for each student through several steps: 1) compute all the shortest paths between any pair of students connected in the network, 2) determine the fraction of shortest paths between this pair that pass through the target student, and 3) sum this fraction over all pairs of students in the network.

Demographics and Academic Achievement

Students were asked to list their student ID (in order to link data over time). The district provided grade level, gender, and ethnic code for each student. The district also provided overall grade point average (GPA) for each student from each of the three trimesters (ranging from 0.00 – 4.00). The three GPA scores were not cumulative and were limited to only the courses taken by the student within each trimester. If students received an "incomplete" grade then it was counted as a "0" for the GPA calculation.

Preparation of Data

Transformations

In order to check the assumption of normality, histograms for all variables were viewed (not shown). At all three waves, social mastery goals have negative skew (as indicated by a tendency for students to rate high), but an examination of the skewness and kurtosis scores suggests that it is within an acceptable range (within +/- 2), thus no transformations are needed. Similarly, students' GPA also has a negative skew, but an

examination of the skewness and kurtosis scores suggests that it is within an acceptable range (within +/- 2); thus no transformations are needed. Finally, at all three waves, betweenness was extremely positively skewed (i.e., many students have few peer connections, and just a few students are highly connected) and it also could be problematic as indicated by skewness and kurtosis scores that were greater than 2. A series of transformations were attempted and the square root transformation best normalized the data. It is not surprising that betweenness required a transformation, as typical social networks are scale-free, meaning that some members of the network have a large number of connections to others whereas most of the members have only a few connections to others (Barabási & Bonabeau, 2003). This scale-free nature of social networks results in a non-normal distribution of connections to others. In all subsequent analyses (e.g., descriptives, correlations, models), the square root of betweenness will be used, although referred to just as betweenness. Descriptive information for these measures and correlations are provided in Chapter 4.

Missing Data

Missing data can take several forms—missing from the entire year due to permissions, missing from an entire wave, or missing some items within the wave. The most common reason for missing data were students missing on an entire wave of the survey, either from entering or leaving the school during the school year, from being absent, or from not filling out the survey. Sample sizes for each survey are presented under the Participants section of this chapter. Table 3.4 shows a missing data analysis and the percentage of data missing for each variable. There is no missing data for the indegree, 2-step in, or betweenness network variables since the number of nominations

received by peers could be calculated even if the student was missing from a particular wave of data. However, an outdegree of "0" and subsequent "0" for 2-Step Out does not make sense if a student did not fill out the survey at that wave. Therefore, for any student that did not fill out the survey at that wave, outdegree and 2-step out were treated as missing data rather than given a score of "0". When relevant, Chapters 4-6 discuss the various ways missing data was treated.

Network analysis is sensitive to missing data, although some minimal missing data is acceptable since non-responders may still receive nominations from others and thus will still be members of the network. There is no specified percentage of missing data allowed because the robustness of analyses rely on the number of network connections that can be listed, whether data is treated as directional or reciprocal, and whether data is missing at random. There are three types of missing data: 1) overall unit non-response, such as individuals excluded from the entire study because of permissions; 2) partial non-response (Huisman & Steglich, 2008) in which individuals may be absent on one wave of surveys; and 3) the boundary specification problem (Laumann, Marsden, & Prensky, 1983) in which individuals are constrained in reporting their networks by the number of options allowed on the survey. These types of missing data can lead to inaccurate estimates of network-level statistics (e.g., Kossinets, 2006). Several steps were taken to remedy the issue of missing data particularly for the social networks, in which missing data cannot easily be imputed because it relies on peer nominations. The number of peers that can be listed in the current study (up to 10) is relatively high across typical social network analysis procedures. Furthermore, both measures of indegree as well as outdegree were included, thus even if a student's survey data was missing on a particular

wave, he or she could still be nominated by others and would have some network data available for that particular wave. Finally, measures were taken to prevent missing data from occurring in the first place, through multiple efforts to obtain permissions and careful survey processing.

Chapter 3 References

Barabasi, A.-L., & Bonabeau, E. (2003). Scale-free networks. *Scientific American, 288*(5), 60–69.

Hopkins, N., & Ryan, A. M. (2000). Expanding achievement goal theory into the social domain. In *Poster presented at the annual meeting of the American Educational Research Association, New Orleans, LA* (p. 16).

Horst, S. J., Finney, S. J., & Barron, K. E. (2007). Moving beyond academic achievement goal measures: A study of social achievement goals. *Contemporary Educational Psychology, 32*(4), 667–698. doi: 10.1016/j.cedpsych.2006.10.011

Huisman, M., & Steglich, C. (2008). Treatment of non-response in longitudinal network studies. *Social Networks, 30*(4), 297–308. doi: 10.1016/j.socnet.2008.04.004

Kindermann, T. A., & Gest, S. D. (2009). Assessment of the peer group identifying naturally occurring social networks and capturing their effects. In Rubin, K. H., Bukowski, W., & Laursen, B. [Eds.], *Handbook of peer interactions, relationships and groups* (pp. 100–117). New York, NY: Guilford Press.

Kossinets, G. (2006). Effects of missing data in social networks. *Social Networks, 28*(3), 247–268. doi: 10.1016/j.socnet.2005.07.002

Laumann, E. O., Marsden, P. V., & Prensky, D. (1983). The boundary specification problem in network analysis. In Burt, R. S., & Minor, M. J. [Eds.], *Applied network analysis: A methodological introduction* (pp. 18–34). Beverly Hills, CA: Sage.

Linnenbrink-Garcia, L., Middleton, M. J., Ciani, K. D., Easter, M. A., O'Keefe, P. A., & Zusho, A. (2012). The strength of the relation between performance-approach and performance-avoidance goal orientations: Theoretical, methodological, and instructional implications. *Educational Psychologist, 47*(4), 281–301. doi: 10.1080/00461520.2012.722515

Midgley, C., Maehr, M. L., Hruda, L. Z., Anderman, E., Anderman, L., Freeman, K. E., Gheen, M., Kaplan, A., Kumar, R., Middleton, M. J., Nelson, J., Roeser, R., & Urdan, T. (2000). Manual for the patterns of adaptive learning scales. *Ann Arbor, 1001,* 48109–1259.

Murayama, K., Elliot, A. J., & Yamagata, S. (2011). Separation of performance-approach and performance-avoidance achievement goals: A broader analysis. *Journal of Educational Psychology, 103*(1), 238–256. doi: 10.1037/a0021948

Ryan, A. M. (2001). The peer group as a context for the development of young adolescent motivation and achievement. *Child development*, *72*(4), 1135–1150.

Ryan, A. M., & Hopkins, N. B. (2003). Achievement goals in the social domain. University of Illinois, Urbana-Champaign, unpublished manuscript.

Table 3.1 Achievement Goal Factors and Items

Factor	Reliability	Inter-item correlations	Items
Academic Mastery Goals	W1 α = .85 W2 α = .87 W3 α = .92	.47 to .58 .48 to .65 .63 to .72	1. Learning a lot of new things is important to me 2. One of my main goals is to improve my skills 3. My main goal is to learn as much as I can 4. Really understanding work is important to me 5. Learning new skills is one of my goals
Academic Performance -Approach Goals	W1 α = .86 W2 α = .85 W3 α = .90	.40 to .66 .35 to .68 .54 to .71	1. Doing better than other students is important to me 2. My goal is to look smarter than other students 3. One of my goals is to show others that school is easy for me 4. It's important to me that others think I am good at school 5. My goal is to do better than other students
Academic Performance -Avoidance Goals	W1 α = .80 W2 α = .78 W3 α = .86	.32 to .60 .29 to .61 .45 to .74	1. My goal is to keep others from thinking I'm not smart 2. It's important t me that I don't look stupid 3. An important reason I do my school work is so that I don't embarrass myself 4. I do my school work so that my teachers don't think I know less than others 5. My goal is to avoid looking like I can't do my work
Social Mastery Goals	W1 α = .87 W2 α = .87 W3 α = .90	.51 to .65 .51 to .71 .56 to .76	1. It is important to me to have friends who really understand me. 2. It is important to me to have friends who truly care about me. 3. It is important to me to work on improving the quality of my relationships with my friends. 4. It is important to me that I feel that I have friends I enjoy spending time with. 5. I want to have friends who are interested in me.
Social Performance -Approach Goals	W1 α = .82 W2 α = .87 W3 α = .86	.47 to .66 .52 to .73 .48 to .79	1. My goal in most social situations is to impress others. 2. It is important to me to be seen as having a lot of friends. 3. I want to be friends with "popular" people. 4. It is important to me that others think of me as popular.
Social Performance -Avoidance Goals	W1 α = .74 W2 α = .79 W3 α = .81	.30 to .60 .40 to .65 .42 to .61	1. My goal is to avoid doing things that would cause others to make fun of me. 2. In social situations I am often concerned about the possibility that others will think I am a loser. 3. I try not to goof up when I am out with people. 4. I am often concerned that others won't like me.

Table 3.2 CFA of the Academic and Social Goal Measures

Goals	# factor	# item	Factor loadings	Chi-Square	CFI	TLI	RMSEA	SRMR
W1 Academic Goals	3	15	.70-.78 .67-.80 .55-.78	$\chi^2(87, n = 709) = 374.15$	.94	.93	.07	.04
W2 Academic Goals	3	15	.68-.81 .60-.78 .49-.78	$\chi^2(87, n = 742) = 589.42$	.90	.88	.09	.06
W3 Academic Goals	3	15	.79-.86 .77-.88 .61-.85	$\chi^2(87, n = 684) = 556.61$	.93	.92	.09	.06
W1 Social Goals	3	13	.71-.84 .69-.82 .53-.74	$\chi^2(62, n = 724) = 254.22$	.95	.94	.07	.05
W2 Social Goals	3	13	.71-.84 .69-.87 .55-.79	$\chi^2(62, n = 730) = 237.55$	.96	.95	.06	.05
W3 Social Goals	3	13	.71-.91 .63-.90 .62-.80	$\chi^2(62, n = 691) = 308.95$	.95	.94	.08	.06

Note. Each row within each factor loadings cells represents the standardized loadings on the mastery, performance-approach, and performance-avoidance factors. CFI = Comparative Fit Index, TLI= Tucker-Lewis Index, RMSEA = Root Mean Square Error of Approximation, SRMR = Standardized Root Mean Square Residual

Table 3.3 CFA Latent Factor Intercorrelations of Academic and Social Goals

	1.	2.	3.	4.	5.	6.
1. W1 Academic Mastery	-					
2. W1 Academic Perf-Approach	.22***	-				
3. W1 Academic Perf-Avoidance	.18***	.82***	-			
4. W1 Social Mastery	.34***	.11*	.13**	-		
5. W1 Social Perf-Approach	-.04	.51***	.44***	.26***	-	
6. W1 Social Perf-Avoidance	.01	.41***	.48***	.26***	.69***	-
	7.	8.	9.	10.	11.	12.
7. W2 Academic Mastery	-					
8. W2 Academic Perf-Approach	.13**	-				
9. W2 Academic Perf-Avoidance	.02	.81***	-			
10. W2 Social Mastery	.34***	.09*	.08	-		
11. W2 Social Perf-Approach	-.14**	.44***	.45***	.13**	-	
12. W2 Social Perf-Avoidance	-.10*	.35***	.46***	.15**	.70***	-
	13.	14.	15.	16.	17.	18.
13. W3 Academic Mastery	-					
14. W3 Academic Perf-Approach	.18***	-				
15. W3 Academic Perf-Avoidance	.08	.66***	-			
16. W3 Social Mastery	.49***	-.01	.00	-		
17. W3 Social Perf-Approach	-.07	.41***	.39***	.00	-	
18. W3 Social Perf-Avoidance	-.09*	.32***	.44***	.09	.70***	-

Note. Scores represent the standardized estimates of CFA latent factor intercorrelations when estimating a model of the six factors simultaneously within each wave; * $p < .05$, ** $p < .01$, *** $p < .001$

Table 3.4 Missing Data Analysis

	Wave 1		Wave 2		Wave 3	
	n	%	n	%	n	%
Academic Mastery	103	12.1	77	9.0	122	14.3
Academic Perf-Approach	103	12.1	77	9.0	124	14.6
Academic Perf-Avoid	103	12.1	78	9.2	121	14.2
Social Mastery	104	12.2	82	9.6	118	13.9
Social Perf-Approach	103	12.1	84	9.9	118	13.9
Social Perf-Avoid	103	12.1	85	10.0	118	13.9
Indegree	0	0.0	0	0.0	0	0.0
Outdegree	92	10.8	73	8.6	115	13.5
2-Step In	0	0.0	0	0.0	0	0.0
2-Step Out	92	10.8	73	8.6	115	13.5
Betweenness	0	0.0	0	0.0	0	0.0
GPA	0	0.0	4	0.5	10	1.2

Note. Percentages based on amount of missing data out of sample size of 851.

CHAPTER 4

A DESCRIPTION OF THE HIGH SCHOOL PEER SOCIAL NETWORK AND MOTIVATIONAL DYNAMICS

The first objective of the study is to describe the dynamics of the high school peer social network and students' motivation. This chapter presents 1) means and standard deviations for students' academic goals, social goals, social network variables, and academic achievement at each wave, 2) sociograms and descriptions of the high school social network and how it changes across the school year, 3) a series of results presenting differences in students' academic goals, social goals, social network variables, and academic achievement by grade level, gender, and race, 4) the interrelationships of academic goals, social goals, social network variables, and academic achievement both within each wave and across waves, and 5) a series of results presenting changes across the school year in academic goals, social goals, social network variables, and academic achievement change across the school year, including demographic differences in those changes.

Descriptives of Students' Academic Goals, Social Goals, Social Network Variables, and Academic Achievement

Table 4.1 provides the ranges, means, and standard deviations for the academic goals (mastery, performance-approach, and performance-avoidance), social goals (mastery, performance-approach, and performance-avoidance), social network variables (indegree, outdegree, in2step, out2step, and betweenness), and academic achievement

(GPA). Academic mastery and social mastery were generally highest across waves (4.0-4.2 on a 5.0 scale) while academic and social performance goals were lower (in the 1.9-2.5 range on a 5.0 scale). Outdegree was higher than indegree, in other words, more students nominated others than received nominations themselves. In a dataset with no missing data, the average indegree and outdegree should be equal since the number of nominations given and received should equal out, however, due to only having a subset of the sample because of permissions, students nominated other students who were not included in our dataset resulting in the differences. Later analyses within this chapter determine whether the variables were significantly different by grade level, gender, and race, as well as whether the variables significantly differ across waves.

The High School Social Network

Sociograms

There are different ways to visualize a network; each provides a different topological representation of the same data (Borgatti, Everett, & Freeman, 2002). In all visualizations, nodes represent students and links represent nominations between them. As shown in Figure 4.1, six different configurations were attempted within the UCINet NetDraw program based on the student network data. Figure 4.1.a shows the circle method, in which all students are laid out around an ellipse. Figure 4.1.b shows the scaling method, where the program finds a set of points in a multidimensional space such that the Euclidean distances among these points corresponds as closely as possible to the input proximities. Figure 4.1.c shows the principal components method, in which the software runs a principal components analysis in which the set of relationships among students is factored into a product of the most dominant eigenvectors. Figure 4.1.d shows

the spring embedded method, in which the layout criteria is based on distances plus equal edge length and proximities are based on geodesic distances, and the image results iteratively into a two-dimensional space. Figure 4.1.e is the Gower classical metric ordination procedure, in which Gower's general similarity coefficient is used to layout the image. Finally, Figure 4.1.f is a layout based on attribute set by the user; here the attribute was set as grade level and thus large distances are set between grade level and small distances are set within grade level. In the end the spring-embedded method was used for the following reasons: 1) it is two-dimensional, 2) it allows most of the individual nodes to be visualized while still retaining a meaningful shape based on connectedness, and 3) it processes relatively quickly.

Within each wave of data, students listed other students whom they regularly hang out with in their school. Some students listed peers who were part of the dataset and others who were not, due to not having permissions to use them. For those whom did not have permission or were missing data, no information was available about the students except for their names as listed by the sample. Therefore, for example, if three students in the dataset listed student #475 (a student who did not have permission to include), then student #475 would have a node in the network but the dataset contains no other data about the student, such as grade level, achievement data, or their scores on the goal measures. In order to visualize this see Figure 4.2. The top sociogram shows all students and their connections from W1, n = 1,144. In other words, among the 851 students in the dataset, 1,144 unique names were listed. The bottom sociogram has visually deleted all nodes without permission and shows only the interconnections among those students for whom permission was received, n = 851. The reduced network retains its general

structure. Note that all network measures used in subsequent analyses, such as indegree and betweenness, are based on the full network of student interconnections listed by those students for whom permission was obtained.

Figures 4.3-4.6 show the social network connections at W1, September 2010. In Figure 4.3 nodes were resized to showcase those students who have greater betweenness. Node sizes were set from 4-10 and nodes with larger betweenness scores were given larger node size. Next, the network was visualized by students' demographics. Figure 4.4 displays the network sized by betweenness and the grade level is distinguished by node color. Figure 4.5 shows gender, and Figure 4.6 shows race. The remaining sociograms for Waves 2 and 3 are in the Appendix (Figures B.1 to B.8). Figures B.1 to B.4 show betweenness, grade level, gender, and race peer connections from W2, January 2011 and Figures B.5 to B.8 show betweenness, grade level, gender, and race peer connections from W3, May 2011.

Looking across the sociograms, it is clear that students cluster together by grade level, as would be expected. Furthermore, there is slightly more overlap between 10^{th} and 11^{th} graders than between 9^{th} graders with 10^{th} and 11^{th} graders, and 10^{th} graders lie between 9^{th} and 11^{th} graders, also as expected. By the end of the year it appears as if 10^{th} and 11^{th} graders are more interconnected than previously. Most of the isolated nodes on the left hand side of the picture are male. Furthermore, it appears as if most of the largest nodes (indicating highest betweenness) are female. Visually, it appears as if students somewhat cluster by race, although still generally within their grade levels. It also appears as if Black students are somewhat on the periphery, located within a clump on the right hand side of the sociogram.

Network Diversity

UCINet software was used to calculate the proportion of outgoing peer connections that occurred within each demographic category of grade level, gender, and race at each wave (Borgatti, Everett, & Freeman, 2002). As described in Chapter 2, peer groups and peer dyads within the school tend to be similar across age, race, and gender, so the same was expected within this sample. When running these types of analyses, the sample decreases because only data for whom friendships are listed can be used, compounded by bringing together many different data files, so the sample size for this analysis was $n = 637$ at W1, $n = 679$ at W2, and $n = 606$ at W3. Table 4.2 shows a comparison of the actual proportion of the demographics of the sample to the proportions of peer nominations listed by students as a way to gauge whether particular demographics of students had more peers connections than would be expected based on their representation within the sample. For example, in Table 4.2, when looking at gender the first column shows that males were 47.0% of the sample, however, the second column shows that on the first survey wave males only received 41.0% of nominations, suggesting that females receive more nominations than males across the school network. Another difference occurred within race. Although Black students account for 13% of the sample, they are only involved in 11%, 10%, and 10% of the peer connections at school at the beginning, middle, and end of the year, respectively. Although it is only slight, this disparity may have consequences for Black students' access to peer social capital as compared to other demographic groups.

Next a heterogeneity score was calculated for each student based on grade level, gender, and race. Heterogeneity score is the proportion of peers out of number of peers

listed that fall into a different category than the student's own. For example, if a student is female and 75% of her friends are female, her heterogeneity score for gender would be .25 (the proportion of her friends who are male). As shown in Table 4.2, on average only 11% of peer connections are to peers outside of a student's grade level, although this increases slightly across the year. Furthermore, only 20% of peer connections are to the opposite gender, increasing to 22% by the end of the year, and finally, 31% of peer connections are to peers outside of a student's racial category, which increased to 34% by the end of the year. In other words, students are most likely to have a friend who is outside of their race, then one who is outside of their gender, and are least likely to have a friend who is outside of their grade level. Finally, the proportion of students who had 0% heterogeneity was calculated, in other words, the proportion of students for whom all of their peer nominations were within their own demographic category. The majority of students (71.1%) had all of their peer nominations within their same grade level although it decreased by the end of the year (62.5%). Approximately half of students (48.4%) had all of their peer nominations within their same gender. Finally, approximately a third of students (34.2%) had all of their peer nominations within their same racial category, although it decreased to only a quarter of students (25.2% and 27.9%) in the second and third trimesters.

Differences in Academic Goals, Social Goals, Social Network Variables, and Academic Achievement by Grade Level, Gender, and Race

In this section students were compared by grade level, gender, and racial category on their mean levels of academic goals, social goals, social network variables, and academic achievement. Since students were measured on all of these at waves 1, 2, and 3,

findings are presented wave by wave within each demographic group. This section thus focuses only on mean level differences. Later in the chapter repeated measures analyses are conducted to determine whether these variables significantly changed across the school year.

Comparisons of Means by Grade Level

The mean scores for 9th, 10th, and 11th graders on all of the study variables across the three waves are shown in Table 4.3. A series of 11 ANOVAs was conducted, one for each variable with the three grade levels as the factor. Due to the number of tests, Bonferroni correction was used for the alpha (.05/11 = .005) in order to reduce the likelihood of a Type 1 error.

With this strict cutoff, at W1 the different grade levels differ in their social performance-approach goals ($F = 5.46$, $p = .004$), social performance-avoidance goals ($F = 9.01$, $p < .001$), outdegree ($F = 8.71$, $p < .001$), in2step ($F = 8.66$, $p < .001$), out2step ($F = 9.57$, $p < .001$), and their betweenness ($F = 8.14$, $p < .001$). According to the Bonferroni post hoc comparisons, 11th graders have lower social performance-approach and social performance-avoidance goals than do 9th graders. 10th graders have higher outdegree, in2step, and out2step than 9th graders, and higher betweenness than 11th graders. At W2 there were less differences than at W1. Using the corrected cutoff, there are grade differences in social performance-avoidance goals ($F = 6.34$, $p = .002$), out2step ($F = 8.02$, $p < .001$), and betweenness ($F = 6.37$, $p = .002$). According to post hoc comparisons, 9th graders had higher social performance-avoidance goals than both 10th and 11th graders, and higher out2step and betweenness than 11th graders. Finally, at W3, none of the goal measures were significantly different at the $p < .005$ level, but all of

the social network measures were significantly different by grade level, including indegree ($F = 13.82$, $p < .001$), outdegree ($F = 10.97$, $p < .001$), in2step ($F = 20.99$, $p < .001$), out2step ($F = 25.43$, $p < .001$), and betweenness ($F = 9.42$, $p < .001$). According to the post hoc comparisons, 9th graders were significantly higher than 10th and 11th graders on indegree, in2step, and betweenness and significantly higher than 11th graders on outdegree. Finally, all grade levels differed on out2step, with freshmen highest and 11th graders lowest.

Comparison of Means by Students' Gender

The mean scores for male and female students on all of the study variables across the three waves are shown in Table 4.4. A series of 11 Independent Samples T-Tests were conducted, one for each variable with gender as the group comparison. Due to the number of tests, a Bonferroni correction was used (.05/11 = .005) to reduce the likelihood of a Type 1 error.

At W1, females had higher social mastery than males ($t = -5.24$, $p < .001$) and males had higher social performance-approach goals than females ($t = 4.74$, $p < .001$). Females had higher indegree than males ($t = -4.95$, $p < .001$), higher outdegree than males ($t = -5.02$, $p < .001$), higher in2step and out2step than males ($t = -5.45$, $p < .001$ and $t = -4.76$, $p < .001$, respectively), higher betweenness than males ($t = -5.90$, $p < .001$), and finally, higher GPA than males ($t = -3.89$, $p < .001$). At W2, females had higher academic mastery than males ($t = -4.63$, $p < .001$), higher social mastery than males ($t = -7.01$, $p < .001$), and males had higher social performance-approach and social performance-avoidance than females ($t = 4.78$, $p < .001$ and $t = 2.88$, $p = .004$, respectively). Females had higher indegree ($t = -3.21$, $p = .001$), outdegree ($t = -5.09$, $p <$

.001), in2step (t = -3.30, p = .001), out2step (t = -4.60, p < .001), and betweenness (t = -4.65, p < .001) than males. Finally, females had higher GPA than males (t = -3.32, p = .001). At W3, females had higher academic mastery (t = -3.61, p < .001) and higher social mastery (t = -9.15, p < .001) than males, while males had higher social performance-approach (t = 6.08, p < .001). Furthermore, females had higher indegree (t = -4.30, p < .001), outdegree (t = -6.81, p < .001), 2stepin (t = -4.82, p < .001), 2stepout (t = -6.95, p < .001), and betweenness (t = -5.09, p < .001) than males. Finally, females had higher GPA than males (t = -3.96, p < .001).

Comparison of Means by Students' Race

The mean scores for the three major racial groups of Black, Asian, and White students on all of the study variables across the three waves are shown in Table 4.5. For these analyses, 14% of the data (n = 121) that fell under the racial category of "other" was filtered out, which included students who identified as multiracial, Hispanic/Latino, Middle Eastern, and so forth. Therefore the following analyses are based on a sample size of 730 students. Although there is heterogeneity within any particular racial category, it was not meaningful to include "other" as a fourth group because of the even greater diversity within the category. A series of 11 ANOVAs were conducted, one for each variable with the three racial groups as the factor. Due to the number of tests, a Bonferroni correction for the alpha (.05/11 = .005) was used in order to reduce the likelihood of a Type 1 error.

At W1, the three racial groups differed in academic mastery goals (F = 7.29, p = .001), academic performance-approach goals (F = 9.85, p < .001), social mastery goals (F = 6.82, p = .001), social performance-avoidance goals (F = 5.92, p = .003), indegree

($F = 16.04$, $p < .001$), in2step ($F = 21.80$, $p < .001$), out2step ($F = 13.89$, $p < .001$), betweenness ($F = 8.22$, $p < .001$), and GPA ($F = 63.89$, $p < .001$). Black and Asian students were higher on academic mastery than White students. Asian students were higher on performance-approach than Black or White students. Black students were lower on social mastery and social performance-avoidance than Asian and White students. Black students were lower on indegree, in2step, out2step, and betweenness as compared to White and Asian students. Finally, all three groups significantly differed in GPA, with Asian highest, followed by White, followed by Black.

At W2, the three racial groups differed by academic mastery goals ($F = 12.01$, $p < .001$), academic performance-approach goals ($F = 6.26$. $p = .002$), social mastery goals ($F = 15.02$, $p < .001$), indegree ($F = 14.71$, $p < .001$), in2step ($F = 20.92$, $p < .001$), out2step ($F = 14.20$, $p < .001$), betweenness ($F = 7.60$, $p = .001$), and GPA ($F = 60.85$, $p < .001$). Asian students were higher on academic mastery than White and Black students, and higher than White students on academic performance-approach. Black students were lower on social mastery than Asian and White students. Black students were lower on indegree, in2step, out2step, and betweenness as compared to White and Asian students. Finally, all three groups significantly differed in GPA, with Asian highest, followed by White, followed by Black.

At W3, the three racial groups differed by academic mastery goals ($F = 7.39$, $p = .001$), social mastery goals ($F = 15.82$, $p < .001$), social performance-avoidance goals ($F = 5.33$, $p = .005$), indegree ($F = 13.26$, $p < .001$), in2step ($F = 24.43$, $p < .001$), out2step ($F = 9.33$, $p < .001$), betweenness ($F = 9.41$, $p < .001$), and GPA ($F = 64.18$, $p < .001$). Asian students had higher academic mastery than White students, while White and Asian

students had higher social mastery and social performance-avoidance goals than Black students. Black students had lower indegree, in2step, out2step, and betweenness than Asian and White students, and lower outdegree than White students. All three groups significantly differed by GPA, again with Asian highest, followed by White, followed by Black.

Relations Between Academic Goals, Social Goals, Social Network Variables, and Academic Achievement

Tables 4.6, 4.7, and 4.8 present the correlation matrices for all variables within each wave. As expected from the latent factor correlations conducting in the Methods section, academic performance-approach and performance–avoidance goals were highly correlated, as were social performance-approach and performance–avoidance goals. Tables 4.9, 4.10, and 4.11 are the zero-order cross-wave correlation matrices for W1 with W2, W2 with W3, and W1 with W3. Without controlling for any other variables, these matrices demonstrate how variables may be related across time. These interrelationships will subsequently be explored in-depth with cross-lagged models in Chapter 5.

Correlation were also examined to determine instances where high degrees of association may be statistically problematic when combined in subsequent multivariate analyses. There were five SNA variables examined: indegree, in2step, outdegree, out2step, and betweenness. The matrices show that indegree and in2step are highly correlated, as are outdegree and out2step. In order to determine whether one or two factors could be created to represent students' social network position using the five variables, an exploratory factor analysis (Principal Component Analysis, with Varimax Rotation with Kaiser Normalization) with the 5 SNA variables at W1, W2, and W3 was

conducted. As shown in Table 4.12, at all three waves two factors emerged, one that linked together indegree and in2step, and a second that linked together outdegree and out2step, while betweenness cross-loaded on the two factors. Furthermore, examining the correlation matrices it was determined that indegree vs. in2step and outdegree vs. out2step do not differentially relate to any of the other variables.

Options were to either 1) create factors by combining indegree and in2step, combining outdegree and out2step, and forcing the betweenness variable with either the "in" factor or the "out" factor, or 2) drop one of the "in" and one of the "out" variables to reduce the problem of high intercorrelations among predictor variables when running models. It is generally recommended not to create a latent variable with only two items (Byrne, 2011; Marsh, Hau, Balla, & Grayson, 1998). Therefore, due to the simplicity of indegree and outdegree, these variables were retained in subsequent analyses and in2step and out2step will not be used in any further analyses. Therefore three variables (indegree, outdegree, and betweenness) will represent students' social network position and they will be treated as individual observed variables, as with GPA. Since betweenness is still highly positively correlated with both indegree and outdegree, all analyses will include a check for any suspected suppression effects in subsequent models where the three network variables are added as predictors.

Changes Across the School Year in Academic Goals, Social Goals, Social Network Variables, and Academic Achievement

Repeated measures ANOVAs were used to determine whether students' academic goals, social goals, social network variables, and GPA significantly changed across the school year from W1 to W2 to W3. In all models, if the assumption of sphericity was not

met then the Greenhouse-Geisser correction was used. Each model also examined whether the change across the school year was different based on students' demographics. Three between-subjects factors were included: grade level, gender, and race. Therefore each model is considered a 2 x 3 x 4 factorial repeated-measures ANOVA design, since gender has two levels (male, female), grade level has three levels (9^{th}, 10^{th}, and 11^{th}), and race has four levels (Asian, Black, White, Other). Since no interactions between demographic variables were of interest, each model was computed with interaction parameters fixed to provide only main effects of grade, gender and race. Repeated measures ANOVA does not allow for post hoc comparisons of the within-subject factor, therefore a series of paired t-tests with Bonferroni correction were used to determine whether change occurred from W1 to W2, W2 to W3, or both.

The first model focused on change in academic mastery goals across the school year. The assumption of sphericity was not met ($p < .001$). There was a significant main effect for academic mastery, $F(1.89,1097.83) = 4.75$, $p < .05$. Tests of within-subjects contrasts suggest that the change in academic mastery across the school year is linear ($p < .01$) and not quadratic. According to the paired t-tests (see Table 4.13), there is no significant change from W1 ($M = 4.10$) to W2 ($M = 4.10$), but then a significant decrease from W2 to W3 ($M = 4.00$). There were no significant effects for grade level, gender, or ethnic group on change in academic mastery (gender was marginally significant at $p < .06$). Therefore academic mastery significantly decreases across the school year and the change across time is not significantly different based on students' gender, race, or grade level.

The next model focused on change in academic performance-approach goals across the school year. The assumption of sphericity was not met ($p < .001$). There was a significant main effect for academic performance-approach goals, $F(1.89,1094.86) = 11.54$, $p < .001$. Tests of within-subjects contrasts suggest that the change in academic performance-approach goals was quadratic ($p < .001$), not linear. According to the paired t-tests (see Table 4.13), there is a significant increase from W1 ($M = 2.42$) to W2 ($M = 2.57$), and then it significantly decreased from W2 to W3 ($M = 2.39$). There were no significant effects for grade level, gender, or racial group on change in academic performance-approach (again, gender was marginally significant at $p < .07$). Therefore, academic performance-approach goals increase and then decrease across the three waves, and the change is not significantly different based on students' gender, race, or grade level.

The third model focused on change in academic performance-avoidance goals across the school year. The assumption of sphericity was not met ($p < .001$). There was a significant main effect for academic performance-avoidance goals, $F(1.92,1116.27) = 19.07$, $p < .001$. Tests of within-subjects contrasts showed that change across the school year is linear ($p < .001$) and quadratic ($p < .01$). According to the paired t-tests (see Table 4.13), there is no change from W1 ($M = 2.47$) to W2 ($M = 2.49$), and then it significantly decreased from W2 to W3 ($M = 2.25$). There were no significant effects for grade level, gender, or racial group on change. Academic performance-avoidance goals were stable across the first half of the year and then dipped, and the change across time is not significantly different based on students' gender, race, or grade level.

The fourth model focused on change in social mastery goals across the school year. The assumption of sphericity was not met ($p < .05$). There was not a significant main effect for social mastery goals, $F(1.97,1144.73) = 1.83$, *ns*. This was confirmed with the paired t-tests (Table 4.13); social mastery goals did not significantly change from W1 ($M = 4.11$) to W2 ($M = 4.15$) to W3 ($M = 4.08$). However, there was an interaction effect for grade level on change in social mastery, $F(3.95,1144.73) = 5.13$, $p < .001$. As shown in Figure 4.7, social mastery goals decrease for 9th graders, stay relatively the same for 10th graders, and generally increase for 11th graders across the school year. There was also an interaction effect for gender on change in social mastery, $F(1.97,1144.73) = 4.99$, $p < .01$. As shown in Figure 4.8, social mastery goals slightly increase for female students across the school year and slightly decrease for male students. There was no significant effect for the interaction of racial group. Therefore, average social mastery goals do not significantly change across the school year, but that overall average masks some important differences across subgroups, specifically grade level and gender.

The fifth model focused on change in social performance-approach goals across the school year. The assumption of sphericity was not met ($p < .01$). There was a significant main effect for social performance-approach goals, $F(1.97,1143.17) = 15.73$, $p < .001$. Tests of within-subjects contrasts suggest that the change in social performance-approach across the school year is linear ($p < .001$). According to the paired t-tests (see Table 4.13), there is no change from W1 ($M = 2.20$) to W2 ($M = 2.13$), and then it significantly decreased from W2 to W3 ($M = 1.96$). There were no significant interaction effects for grade level, gender, or racial group. Therefore social performance-approach

goals decrease across the school year and the change across time is not significantly different based on students' gender, race, or grade level.

The sixth goal model focused on change in social performance-avoidance goals across the school year. The assumption of sphericity was not met ($p < .05$). There was a significant main effect for social performance-avoidance goals, $F(1.97,1143.47) = 15.73$, $p < .001$. Tests of within-subjects contrasts showed that change across the school year is linear ($p < .01$) and quadratic ($p < .01$). According to the paired t-tests (see Table 4.13), there is no change from W1 ($M = 2.23$) to W2 ($M = 2.27$), and then it significantly decreased from W2 to W3 ($M = 2.13$). There were no significant interaction effects for grade level, gender, or racial group. Similar to academic performance-avoidance, social performance-avoidance goals stayed stable across the first half of the year and then dipped, and the change across time is not significantly different based on students' gender, race, or grade level.

Next were the models for the social network variables. The first model focused on change in indegree across the school year. The assumption of sphericity was not met ($p < .001$). There was a significant main effect for indegree, $F(1.96,1656.97) = 19.68$, $p < .001$. Tests of within-subjects contrasts showed that change across the school year in indegree is quadratic ($p < .001$). According to the paired t-tests (see Table 4.13), indegree significantly increases from W1 ($M = 3.74$) to W2 ($M = 4.29$), and then it decreases from W2 to W3 ($M = 3.68$). There was also a significant interaction for grade level, $F(3.93,1656.97) = 17.52$, $p < .001$. As shown in Figure 4.9, 9th graders have the most drastic increase in the number of nominations they receive from peers, which makes sense considering they were new to the school at the first wave, then their indegree stays

relative high while 10th and 11th graders' indegree drops substantially from W2 to W3. The gender and race interactions were not significant. Thus indegree increases and decreases across the year although it changes differently based on students' grade level.

The next model focused on change in outdegree across the school year. The assumption of sphericity was not met ($p < .001$). There was a significant main effect for outdegree, $F(1.89,1130.22) = 15.09$, $p < .001$. Tests of within-subjects contrasts showed that the change in outdegree across the school year was quadratic ($p < .001$). According to the paired t-tests (see Table 4.13), outdegree significantly increases from W1 ($M = 5.52$) to W2 ($M = 6.16$), and then it decreases from W2 to W3 ($M = 5.55$). There was also a significant interaction effect for grade level, $F(3.77,1130.22) = 13.90$, $p < .001$. As shown in Figure 4.10, 9th graders' number of friends listed on the survey increased more between the beginning and middle of the year as compared to 10th and 11th graders, and while they slightly decreased from middle to the end of the year, 10th and 11th graders' outdegree decreased more drastically. 9th graders start out lowest on outdegree and end up highest by the end of the year. Gender and race interactions were not significant. Therefore outdegree increases and decreases across the year although it changes differently based on students' grade level.

The third network model focused on change in betweenness across the school year. As a reminder, this is the square root of betweenness, which is a measure of how broadly a student is connected. Betweenness is calculated as the sum of the number of paths that the student is located on that are between all pairs of students within the network. The assumption of sphericity was not met ($p < .05$). There was a significant main effect for betweenness, $F(1.98,1673.16) = 7.76$, $p < .001$. Tests of within-subjects

contrasts showed that the change in betweenness was quadratic ($p < .001$). According to the paired t-tests (see Table 4.13), betweenness was similar to indegree and outdegree in that it significantly increases from W1 ($M = 42.57$) to W2 ($M = 47.66$), and then it decreases from W2 to W3 ($M = 42.13$). There was also a significant interaction effect for grade level, $F(3.97,1673.16) = 9.08$, $p < .001$. As shown in Figure 4.11, 9th graders' betweenness in the school network increased more between the beginning and middle of the year as compared to 10th and 11th graders, and from W2 to W3 10th graders and to a lesser extent 11th graders' betweenness decreased more drastically than 9th graders. 11th graders had the lowest betweenness across the entire school year. Gender and race interactions were not significant. Therefore betweenness increases and decreases across the year on average, although it changes differently based on students' grade level.

The final model focuses on change in GPA across the school year. As a reminder, GPA was calculated within each wave and was not cumulative, so the repeated measures analysis is appropriate. The assumption of sphericity was met (the only time across all the models). There was a significant main effect for GPA, $F(2,1668) = 11.51$, $p < .001$. Tests of within-subjects contrasts showed that the change in GPA was both linear ($p < .01$) and quadratic ($p < .001$). According to the paired t-tests (see Table 4.13), GPA decreases from W1 ($M = 3.33$) to W2 ($M = 3.24$), but then remains stable from W2 to W3 ($M = 3.27$). There was also a significant interaction effect for grade level, $F(4,1668) = 14.34$, $p < .001$. As shown in Figure 4.12, all grade levels decreased from W1 to W2, but then while 9th and 10th graders continued to decrease from W2 to W3, 11th graders increased (from a GPA of about 3.10 to 3.29). This could be due to 11th grade students' awareness that college applications are approaching, or to various curricular decisions at the school.

Gender and race interactions were not significant. Therefore, despite significant gender and race differences in GPA at each wave across the school year as shown in Tables 4.4 and 4.5 (e.g., females higher than males), the rate of change across the school year was not significantly different by gender or race. In contrast, there were not significant grade level differences in GPA at any of the waves across the school year, yet the rate of change across the year was significantly different by grade level.

In summary, almost all of the variables—academic performance-approach goals, academic performance-avoidance goals, social mastery goals, social performance-approach goals, social performance-avoidance goals, indegree, outdegree, betweenness, and GPA—significantly changed across the school year. The only exception was social mastery, however, social mastery did change across the school year differently when taking into account the interaction with gender and grade level differences. Not all changes in the variables were linear; only academic mastery and social performance-approach had linear decreases, while the rest were either quadratic or a combination of linear and quadratic, which suggests an important contribution of the three wave rather than a two wave (beginning and end of year) design.

Chapter 4 References

Borgatti, S. P., Everett, M. G., & Freeman, L. S. (2002). *UCINet 6 for Windows*. Harvard: Analytic Technologies. Retrieved on Jan 6, 2013 from www.analytictech.com/ucinet/documentation/usersguide.doc

Byrne, B. M. (2011). *Structural Equation Modeling with MPlus: Basic Concepts, Applications, and Programming*. New York: Routledge.

Table 4.1 Descriptives of Variables

		Wave 1		Wave 2		Wave 3	
	Range	***M***	***SD***	***M***	***SD***	***M***	***SD***
Academic Mastery	1.00-5.00	4.10	0.77	4.10	0.73	4.00	0.86
Academic Perf-Approach	1.00-5.00	2.42	0.95	2.57	0.90	2.39	1.03
Academic Perf-Avoid	1.00-5.00	2.47	0.97	2.49	0.87	2.25	1.00
Social Mastery	1.00-5.00	4.11	0.84	4.15	0.83	4.08	0.93
Social Perf-Approach	1.00-5.00	2.20	0.89	2.13	0.89	1.96	0.83
Social Perf-Avoid	1.00-5.00	2.23	0.88	2.27	0.89	2.13	0.89
Indegree	0-16	3.74	3.14	4.29	3.16	3.68	2.95
Outdegree	0-10	5.52	3.52	6.16	3.47	5.55	3.55
2-Step In	0-76	14.04	12.81	17.88	14.68	13.81	11.91
2-Step Out	0-86	20.59	14.89	25.45	16.46	20.67	15.44
Betweenness	0-216.94	42.57	42.15	47.66	40.24	42.13	40.51
GPA	0.00-4.00	3.33	0.75	3.24	0.86	3.27	0.83

Note. Betweenness is the square root transformation of betweenness.

Table 4.2 Peer Connections by Demographics

	% within total sample	% of outgoing connections at W1 (*n* = 637)	% of outgoing connections at W2 (*n* = 679)	% of outgoing connections at W3 (*n* = 606)
Grade Level				
9th grade	35.4	36.0	37.5	39.6
10th grade	33.4	34.4	30.5	30.8
11th grade	31.3	29.5	31.9	29.6
Average heterogeneity		11.1	13.6	14.9
% that had 0 heterogeneity		453/637 = 71.1%	437/679 = 64.4%	379/606 = 62.5%
Gender				
Male	47.0	41.0	43.7	42.8
Female	53.0	59.0	56.3	57.2
Average heterogeneity		20.5	21.8	21.6
% that had 0 heterogeneity		308/637 = 48.4%	311/679 = 45.8%	280/606 = 46.2%
Race				
Black	12.5	10.6	10.3	10.4
Asian	10.8	11.5	11.3	12.7
White	62.5	65.4	64.5	62.9
Other	14.2	12.5	13.9	14.0
Average heterogeneity		30.6	35.2	34.3
% that had 0 heterogeneity		218/637 = 34.2%	171/679 = 25.2%	169/606 = 27.9%

Note. *Average heterogeneity* refers to the average percentage of nominations listed that were heterogeneous.

Table 4.3 Grade Level Comparisons on All Variables

	Wave 1 Means			Wave 2 Means			Wave 3 Means		
	9th	**10th**	**11th**	**9th**	**10th**	**11th**	**9th**	**10th**	**11th**
Academic Mastery	4.12	4.10	4.08	4.11	4.10	4.11	3.92	4.08	4.01
Academic Perf-App	2.36	2.42	2.50	2.49	2.58	2.66	2.26	2.40	2.53
Academic Perf-Avoid	2.57	2.38	2.46	2.52	2.42	2.51	2.24	2.21	2.29
Social Mastery	4.19	4.11	3.99	4.17	4.17	4.12	4.01	4.20	4.03
Social Perf-App[a]	2.33	2.16	2.07	2.20	2.08	2.11	2.02	1.90	1.95
Social Perf-Avoid[a, b]	2.40	2.19	2.08	2.42	2.18	2.19	2.24	2.06	2.07
Indegree[c]	3.48	4.18	3.56	4.57	4.36	3.91	4.36	3.49	3.12
Outdegree[a, c]	4.85	6.03	5.77	6.28	6.39	5.77	6.23	5.51	4.74
2-Step In[a, c]	12.05	16.40	13.78	19.35	18.18	15.91	17.19	12.75	11.12
2-Step Out[a, b, c]	17.81	23.28	20.96	27.72	26.09	22.09	25.11	20.39	15.48
Betweenness[a, b, c]	39.99	49.96	37.61	52.16	49.51	40.58	50.12	38.76	36.68
GPA	3.39	3.33	3.25	3.27	3.26	3.18	3.25	3.22	3.34

Note.
a. Significantly different across grade levels at W1.
b. Significantly different across grade levels at W2.
c. Significantly different across grade levels at W3.

Table 4.4 Gender Comparisons on All Variables

	Wave 1 Means		Wave 2 Means		Wave 3 Means	
	Female	**Male**	**Female**	**Male**	**Female**	**Male**
Academic Mastery[b, c]	4.14	4.06	4.21	3.98	4.10	3.87
Academic Perf-Approach	2.38	2.47	2.61	2.53	2.31	2.48
Academic Perf-Avoid	2.49	2.45	2.53	2.44	2.24	2.26
Social Mastery[a, b, c]	4.26	3.94	4.34	3.93	4.36	3.76
Social Perf-Approach[a, b, c]	2.05	2.36	1.99	2.30	1.79	2.16
Social Perf-Avoid[b]	2.17	2.31	2.19	2.37	2.06	2.21
Indegree[a, b, c]	4.23	3.18	4.62	3.93	4.09	3.23
Outdegree[a, b, c]	6.10	4.84	6.74	5.49	6.35	4.61
2-Step In[a, b, c]	16.26	11.55	19.44	16.13	15.64	11.75
2-Step Out[a, b, c]	22.96	17.87	27.93	22.56	24.21	16.53
Betweenness[a, b, c]	50.44	33.70	53.63	40.92	48.69	34.73
GPA[a, b, c]	3.42	3.22	3.33	3.14	3.38	3.15

Note.
a. Significantly different between genders at W1.
b. Significantly different between genders at W2.
c. Significantly different between genders at W3.

Table 4.5 Comparisons on All Variables by Student Race

	Wave 1 Means			Wave 2 Means			Wave 3 Means		
	Black	**Asian**	**White**	**Black**	**Asian**	**White**	**Black**	**Asian**	**White**
Academic Mastery[a, b, c]	4.27	4.29	4.04	4.16	4.43	4.04	4.02	4.32	3.93
Academic Perf-App[a, b, c]	2.26	2.82	2.38	2.59	2.89	2.53	2.41	2.67	2.36
Academic Perf-Avoid	2.67	2.42	2.44	2.59	2.33	2.49	2.48	2.07	2.26
Social Mastery[a,b, c]	3.84	4.25	4.14	3.78	4.41	4.18	3.62	4.27	4.17
Social Perf-App	2.16	2.25	2.21	2.20	2.01	2.13	1.91	1.93	1.99
Social Perf-Avoid[a, c]	2.00	2.44	2.25	2.09	2.40	2.28	1.88	2.29	2.19
Indegree[a, b, c]	2.22	4.27	4.01	2.80	4.87	4.50	2.44	4.40	3.81
Outdegree	4.50	5.98	5.67	5.27	6.76	6.23	4.74	5.93	5.79
2-Step In[a, b, c]	6.84	16.47	15.22	9.80	21.07	19.00	6.90	17.08	14.69
2-Step Out[a, b, c]	13.63	23.64	21.75	18.16	30.25	26.34	14.81	23.17	22.15
Betweenness[a, b, c]	27.43	46.88	45.11	36.45	58.40	49.52	27.95	49.84	45.14
GPA[a, b, c]	2.73	3.80	3.39	2.60	3.79	3.32	2.61	3.81	3.34

Note.
a. Significantly different between genders at W1.
b. Significantly different between genders at W2.
c. Significantly different between genders at W3.

Table 4.6 Intercorrelations of Wave 1 Variables

	1	2	3	4	5	6	7	8	9	10	11	12
1. Acad Mas	-											
2. Acad Papp	.21**	-										
3. Acad Pav	.15**	.67**	-									
4. Soc Mas	.30**	.11**	.14**	-								
5. Soc Papp	-.01	.44**	.38**	.25**	-							
6. Soc Pav	.04	.35**	.40**	.24**	.57**	-						
7. Indegree	.09*	.03	-.05	.25**	-.05	-.09*	-					
8. Outdegree	.07	.02	-.04	.21**	.06	-.05	.43**	-				
9. In2step	.09*	.06	-.04	.25**	-.05	-.09*	.92**	.43**	-			
10. Out2step	.10**	.05	-.02	.24**	.04	-.01	.41**	.87**	.46**	-		
11. Between	.09*	.02	-.03	.23**	-.01	-.06	.63**	.65**	.66**	.69**	-	
12. GPA	.14**	.13**	-.01	.24**	.01	.08*	.29**	.18**	.30**	.25**	.26**	-

Note. Table presents Pearson correlation coefficients. Acad Mas = academic mastery goal; Acad Papp = academic performance-approach goal; Acad Pav = academic performance-avoidance goal; Soc Mas = social mastery goal; Soc Papp = social performance-approach goal; Soc Pav = social performance-avoidance goal; Between = betweenness, GPA = grade point average. * correlation is significant at $p < .05$; ** correlation is significant at $p < .01$

Table 4.7 Intercorrelations of Wave 2 Variables

	1	2	3	4	5	6	7	8	9	10	11	12
1. Acad Mas	-											
2. Acad Papp	.14**	-										
3. Acad Pav	.03	.66**	-									
4. Soc Mas	.31**	.08*	.09*	-								
5. Soc Papp	-.12**	.39**	.41**	.14**	-							
6. Soc Pav	-.09*	.29**	.40**	.13**	.59**	-						
7. Indegree	.11**	.07*	-.04	.25**	-.01	-.12**	-					
8. Outdegree	.12**	.05	.01	.32**	.11**	-.02	.39**	-				
9. In2step	.11**	.09*	-.04	.23**	.01	-.11**	.91**	.37**	-			
10. Out2step	.15**	.08*	.02	.32**	.10**	.02	.39**	.85**	.42**	-		
11. Between	.12**	.07*	.02	.29**	.06	-.07*	.63**	.66**	.65**	.72**	-	
12. GPA	.21**	.16**	-.08*	.23**	-.11**	-.00	.27**	.13**	.31**	.21**	.21**	-

Note. Table presents Pearson correlation coefficients. Acad Mas = academic mastery goal; Acad Papp = academic performance-approach goal; Acad Pav = academic performance-avoidance goal; Soc Mas = social mastery goal; Soc Papp = social performance-approach goal; Soc Pav = social performance-avoidance goal; Between = betweenness, GPA = grade point average. * correlation is significant at $p < .05$; ** correlation is significant at $p < .01$

Table 4.8 Intercorrelations of Wave 3 Variables

	1	2	3	4	5	6	7	8	9	10	11	12
1. Acad Mas	-											
2. Acad Papp	.17**	-										
3. Acad Pav	.08*	.62**	-									
4. Soc Mas	.45**	.03	.01	-								
5. Soc Papp	-.03	.41**	.38**	.07	-							
6. Soc Pav	-.04	.31**	.44**	.11**	.63**	-						
7. Indegree	.06	.01	-.07	.20**	-.07	-.08*	-					
8. Outdegree	.11**	.00	-.08*	.31**	.04	-.02	.35**	-				
9. In2step	.05	.03	-.07	.23**	-.06	-.08*	.91**	.35**	-			
10. Out2step	.10**	.02	-.08*	.30**	.05	.01	.33**	.84**	.38**	-		
11. Between	.09*	.06	-.03	.31**	.03	-.02	.56**	.68**	.60**	.73**	-	
12. GPA	.22**	.11**	-.09*	.22**	-.07*	.02	.27**	.24**	.30**	.27**	.27**	-

Note. Table presents Pearson correlation coefficients. Acad Mas = academic mastery goal; Acad Papp = academic performance-approach goal; Acad Pav = academic performance-avoidance goal; Soc Mas = social mastery goal; Soc Papp = social performance-approach goal; Soc Pav = social performance-avoidance goal; Between = betweenness, GPA = grade point average. * correlation is significant at $p < .05$; ** correlation is significant at $p < .01$

Table 4.9 Intercorrelations of Wave 1 by Wave 2 Variables

	W2											
W1	1	2	3	4	5	6	7	8	9	10	11	12
1. Acad Mas	.57**	.12**	.05	.16**	-.05	-.07	.13**	.08*	.12**	.10*	.08*	.15**
2. Acad Papp	.14**	.63**	.44**	.03	.26**	.19**	.05	.05	.06	.09*	.04	.13**
3. Acad Pav	.06	.42**	.55**	.03	.22**	.22**	-.03	.03	-.03	.06	.06	-.03
4. Soc Mas	.23**	.10**	.09*	.55**	.04	.08*	.26**	.20**	.26**	.25**	.23**	.22**
5. Soc Papp	-.07	.28**	.28**	.08*	.57**	.30**	.02	.15**	.04	.18**	.10**	-.01
6. Soc Pav	-.01	.21**	.27**	.10*	.28**	.50**	-.04	.03	-.04	.08*	.05	.08*
7. Indegree	.09**	.04	-.06	.28**	-.03	-.12**	.71**	.35**	.65**	.31**	.45**	.29**
8. Outdegree	.05	-.00	-.03	.18**	.03	-.07	.39**	.58**	.39**	.51**	.39**	.20**
9. In2step	.10**	.05	-.06	.27**	-.03	-.12**	.67**	.34**	.68**	.34**	.45**	.29**
10. Out2step	.10*	.02	-.02	.19**	-.00	-.05	.37**	.52**	.40**	.55**	.42**	.26**
11. Between	.07	.02	-.03	.22**	-.03	-.09*	.45**	.39**	.46**	.41**	.43**	.23**
12. GPA	.23**	.15**	-.05	.28**	-.09*	.02	.28**	.16**	.31**	.23**	.22**	.85**

Note. Table presents Pearson correlation coefficients. Rows represent W1 variables and columns represent W2 variables. Numbers in cells are Pearson correlation coefficients. Acad Mas = academic mastery goal; Acad Papp = academic performance-approach goal; Acad Pav = academic performance-avoidance goal; Soc Mas = social mastery goal; Soc Papp = social performance-approach goal; Soc Pav = social performance-avoidance goal; Between = betweenness, GPA = grade point average. * correlation is significant at $p < .05$; ** correlation is significant at $p < .01$

Table 4.10 Intercorrelations of Wave 2 by Wave 3 Variables

	W3											
W2	1	2	3	4	5	6	7	8	9	10	11	12
1. Acad Mas	.61**	.08*	-.01	.26**	-.10**	-.08*	.09*	.10*	.09*	.12**	.09*	.22**
2. Acad Papp	.10*	.63**	.37**	.07	.28**	.21**	.03	.06	.05	.09*	.08*	.18**
3. Acad Pav	.03	.42**	.56**	.05	.25**	.28**	-.04	-.03	-.03	-.00	-.01	-.03
4. Soc Mas	.29**	.00	-.01	.55**	.04	.09*	.26**	.25**	.26**	.25**	.20**	.27**
5. Soc Papp	-.11**	.34**	.30**	-.07	.57**	.28**	-.01	-.00	-.00	.01	.02	-.07
6. Soc Pav	-.07	.25**	.34**	-.00	.36**	.53**	-.08*	-.04	-.07	-.01	-.04	-.01
7. Indegree	.09*	.03	-.10**	.20**	-.06	-.12**	.70**	.34**	.65**	.30**	.40**	.26**
8. Outdegree	.08*	.01	-.01	.23**	.09*	-.02	.31**	.57**	.30**	.47**	.38**	.16**
9. In2step	.07	.04	-.11**	.20**	-.03	-.11**	.65**	.33**	.68**	.33**	.41**	.30**
10. Out2step	.09*	.04	-.01	.23**	.11**	.03	.30**	.50**	.33**	.54**	.41**	.22**
11. Between	.09*	.03	-.04	.22**	.04	-.06	.45**	.40**	.45**	.40**	.46**	.22**
12. GPA	.17**	.07*	-.12**	.21**	-.08*	.03	.27**	.24**	.31**	.29**	.27**	.85**

Note. Table presents Pearson correlation coefficients. Rows represent W2 variables and columns represent W3 variables. Numbers in cells are Pearson correlation coefficients. Acad Mas = academic mastery goal; Acad Papp = academic performance-approach goal; Acad Pav = academic performance-avoidance goal; Soc Mas = social mastery goal; Soc Papp = social performance-approach goal; Soc Pav = social performance-avoidance goal; Between = betweenness, GPA = grade point average. * correlation is significant at $p < .05$; ** correlation is significant at $p < .01$

Table 4.11 Intercorrelations of Wave 1 by Wave 3 Variables

	W3											
W1	1	2	3	4	5	6	7	8	9	10	11	12
1. Acad Mas	.44**	.06	.02	.15**	-.09*	-.09*	.11**	.09*	.10**	.09*	.12**	.14**
2. Acad Papp	.08	.51**	.33**	.03	.22**	.16**	.03	-.02	.04	.02	.04	.14**
3. Acad Pav	.04	.29**	.46**	.02	.16**	.16**	.01	-.05	.02	-.01	.02	-.02
4. Soc Mas	.22**	.05	.03	.49**	-.04	.03	.25**	.23**	.28**	.26**	.23**	.21**
5. Soc Papp	-.08*	.23**	.22**	-.01	.46**	.25**	.02	.06	.03	.09*	.09*	-.03
6. Soc Pav	-.03	.16**	.23**	.06	.25**	.41**	-.01	-.00	-.01	.05	.04	.04
7. Indegree	.07	.00	-.15**	.23**	-.06	-.13**	.61**	.31**	.58**	.27**	.34**	.28**
8. Outdegree	.03	.04	-.05	.18**	.01	-.04	.30**	.43**	.29**	.36**	.31**	.19**
9. In2step	.10**	.04	-.13**	.25**	-.05	-.14**	.56**	.30**	.58**	.28**	.35**	.28**
10. Out2step	.08	.04	-.05	.23**	-.00	-.02	.26**	.37**	.28**	.38**	.33**	.24**
11. Between	.04	.01	-.09*	.23**	-.04	-.10**	.38**	.33**	.41**	.32**	.37**	.23**
12. GPA	.18**	.08*	-.08*	.23**	-.06	.06	.30**	.27**	.32**	.30**	.27**	.82**

Note. Table presents Pearson correlation coefficients. Rows represent W1 variables and columns represent W3 variables. Numbers in cells are Pearson correlation coefficients. Acad Mas = academic mastery goal; Acad Papp = academic performance-approach goal; Acad Pav = academic performance-avoidance goal; Soc Mas = social mastery goal; Soc Papp = social performance-approach goal; Soc Pav = social performance-avoidance goal; Between = betweenness, GPA = grade point average. * correlation is significant at $p < .05$; ** correlation is significant at $p < .01$

Table 4.12 Exploratory Factor Analysis of the Network Variables

	Wave 1		**Wave 2**		**Wave 3**	
Variance explained	90.53%		90.33%		90.13%	
	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2
Indegree	.95	.21	.20	.95	.18	.95
In2Step	.95	.24	.22	.95	.22	.95
Between	.64	.63	.68	.60	.73	.54
Outdegree	.21	.93	.93	.17	.93	.15
Out2Step	.23	.94	.94	.21	.94	.16

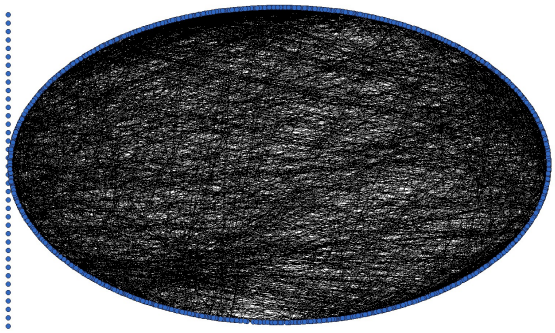
Note. Coefficients are from the rotated component matrix.

Table 4.13 Paired T-Tests to Determine Change in the Study Variables

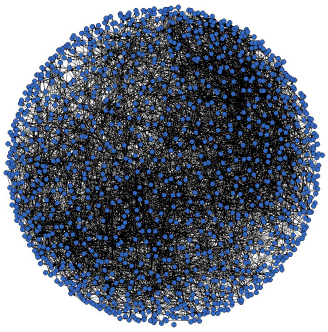
	W1 to W2			W2 to W3		
	Δ Mean	t-value	Change	Δ Mean	t-value	Change
Academic Mastery	.02	0.87	same	.10	3.76***	decrease
Academic Perf-Approach	-.14	-4.55***	increase	.20	6.10***	decrease
Academic Perf-Avoidance	.00	-0.03	same	.26	7.53***	decrease
Social Mastery	-.03	-1.04	same	.05	1.63	same
Social Perf-Approach	.09	2.87	same	.17	5.65***	decrease
Social Perf-Avoidance	-.03	-0.78	same	.14	4.29***	decrease
Indegree	-.56	-6.68***	increase	.61	7.52***	decrease
Outdegree	-.68	-5.56***	increase	.57	4.62***	decrease
Betweenness	-5.08	-3.37**	increase	5.53	3.83***	decrease
GPA	.09	5.68***	decrease	-.02	-1.18	same

Note. Positive values in change of mean indicate a decrease in the variable and negative values in change of mean indicate an increase in the variable, since it is a subtraction (e.g., W1-W2). Due to the number of tests, a Bonferroni correction was used to control for error. There were 20 t-tests, therefore the cutoff is .05/20 = .003. ** $p < .003$, *** $p < .001$.

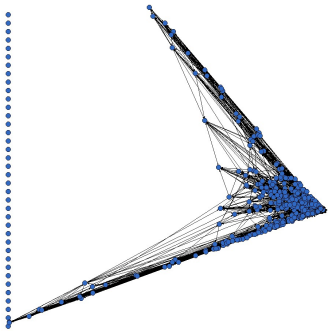
a. Circle



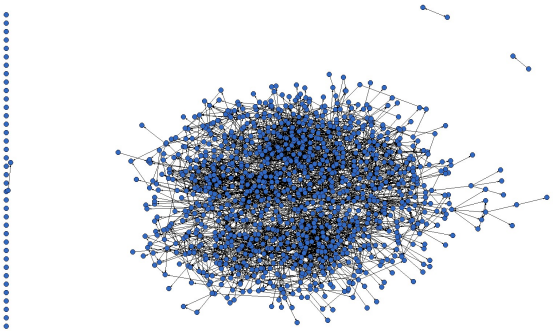
b. Scaling – Iterative Method MDS



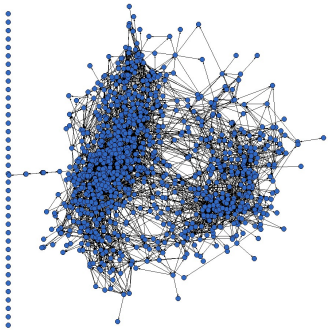
c. Principal components



d. Spring-embedded



e. Gower



f. Grouped by attribute – grade level

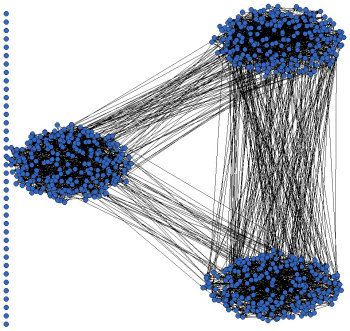


Figure 4.1 Representation of different layouts for the sociograms

Note. The above representations show the social network connections from W1 (September 2010)

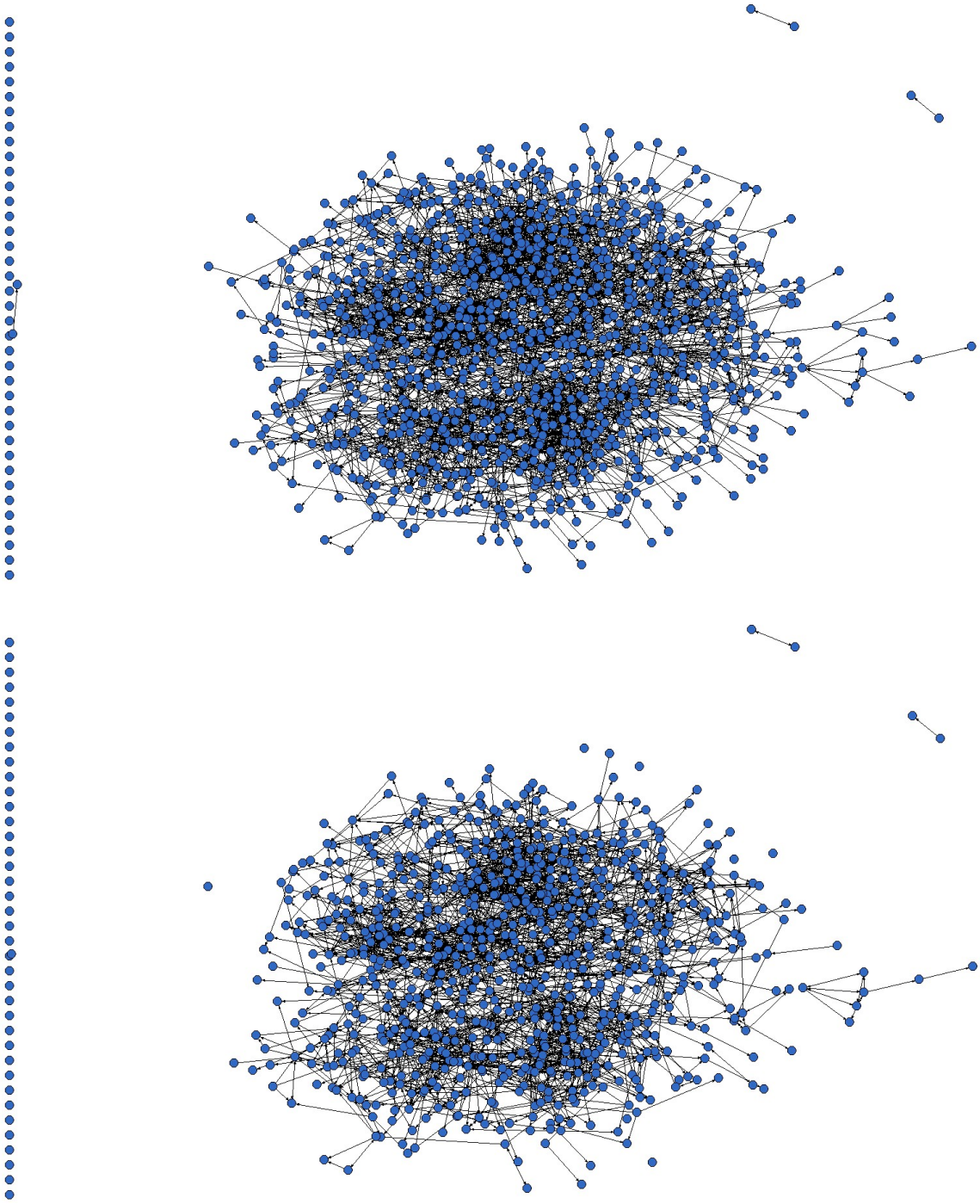


Figure 4.2 Comparison of the sample's full network and sample-only interconnections

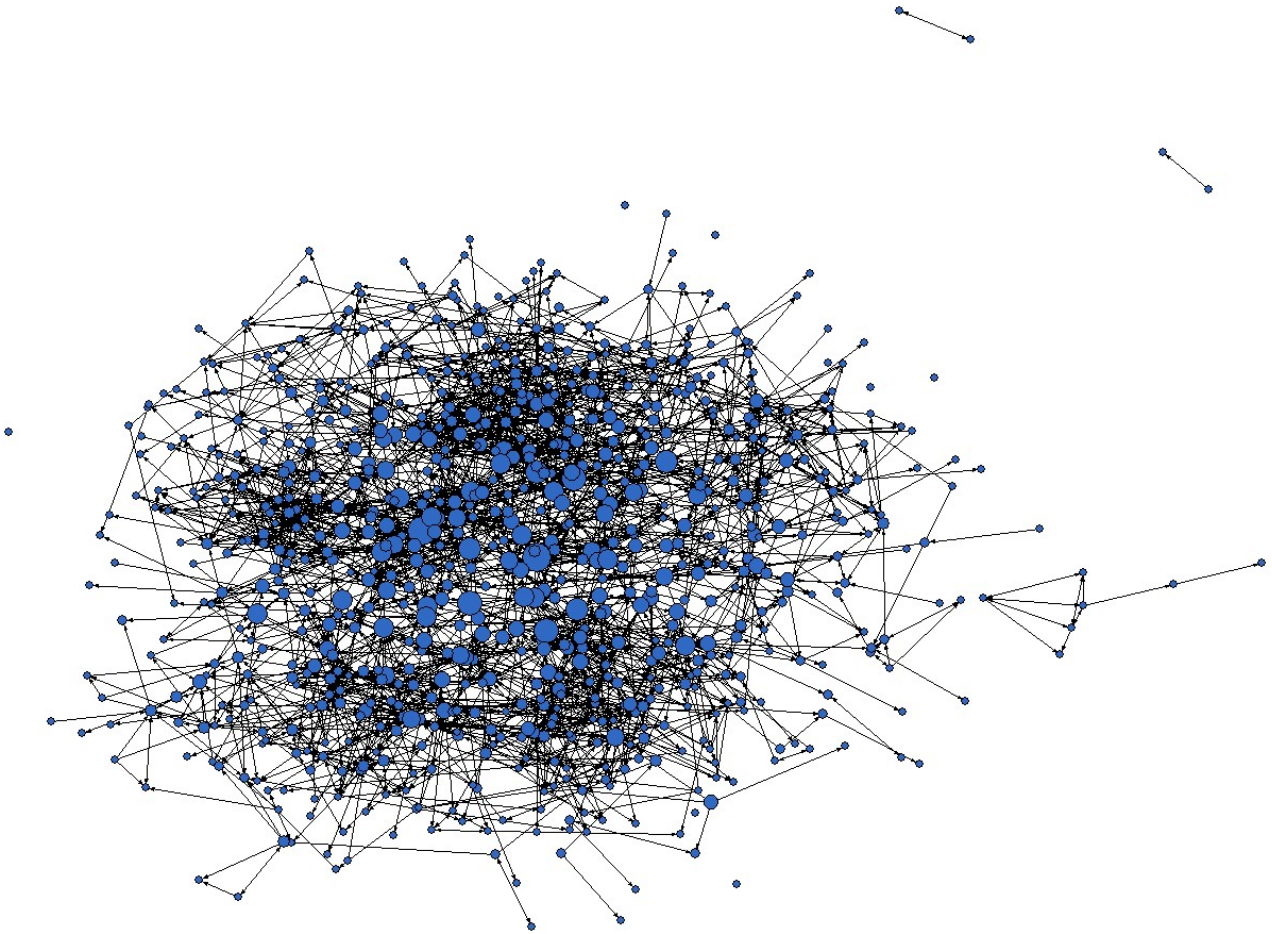


Figure 4.3 Wave 1 Network Sized by Betweenness

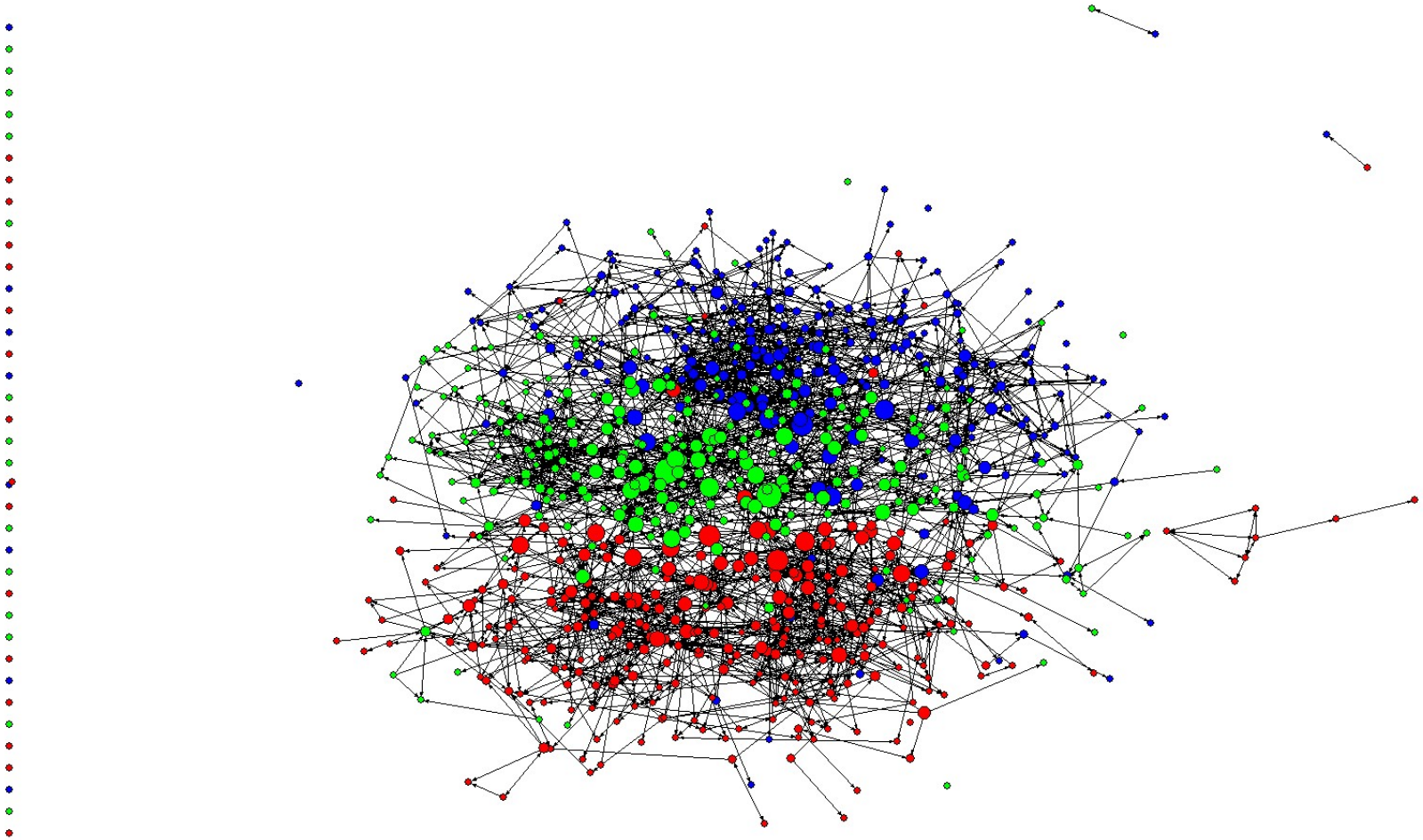


Figure 4.4 Wave 1 Network Sized by Betweenness and Node Color by Grade Level

Note. Red = 9th graders, Green = 10th graders, Blue = 11th graders

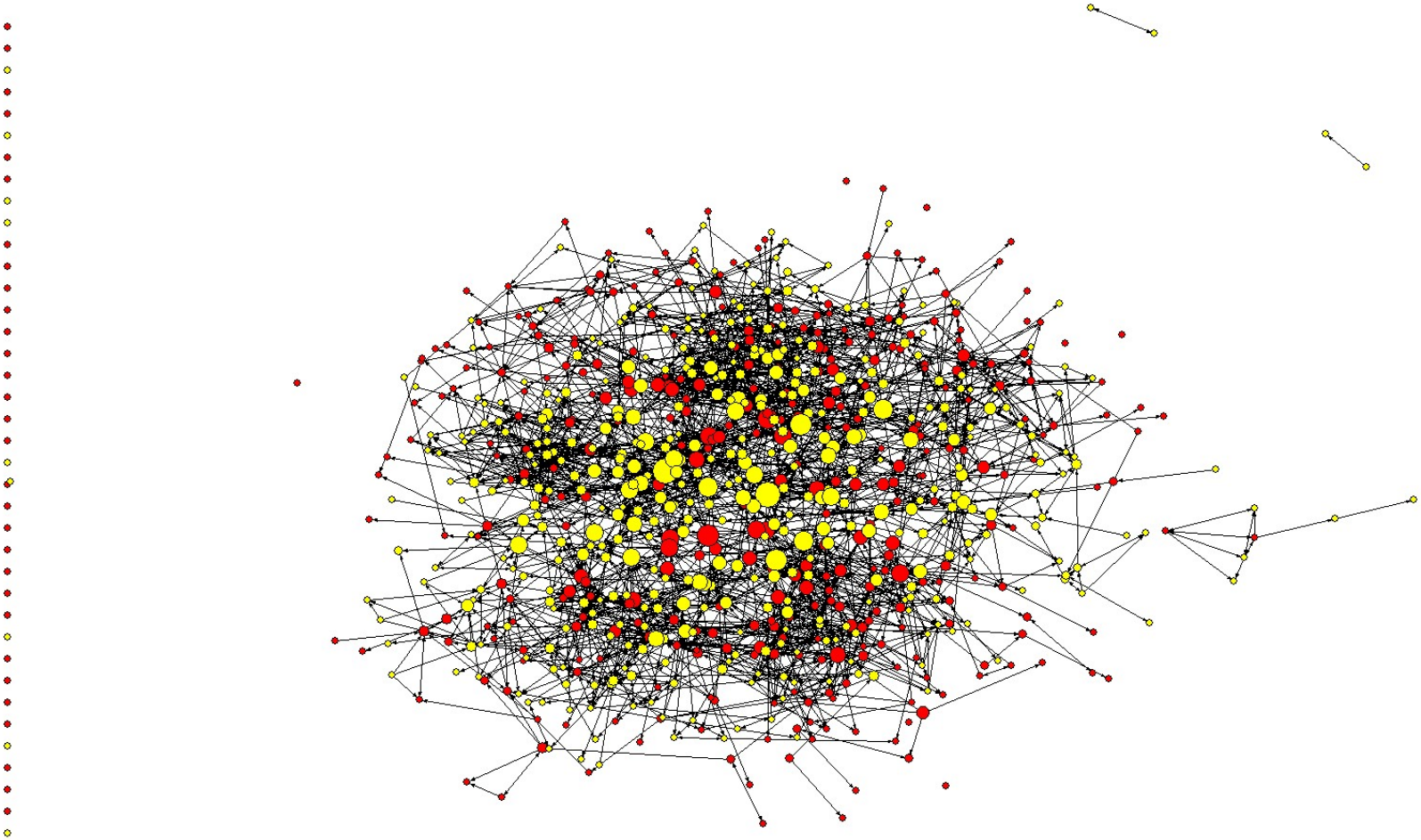


Figure 4.5 Wave 1 Network Sized by Betweenness and Node Color by Gender

Note. Yellow = Female, Red = Male.

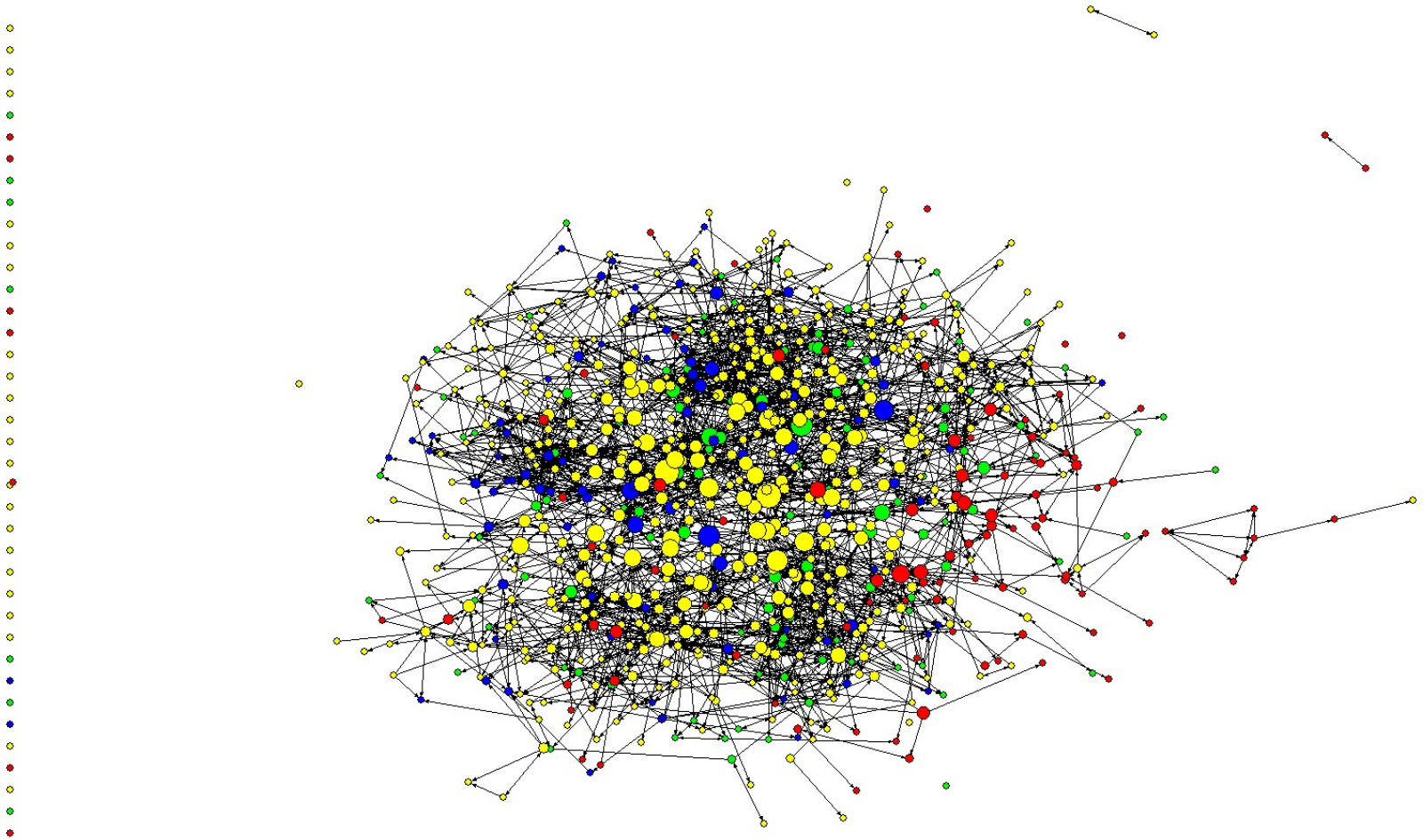


Figure 4.6 Wave 1 Network Sized by Betweenness and Node Color by Race

Note. Yellow = White students, Red = Black students, Blue =Asian students, Green = Multiethnic or Other.

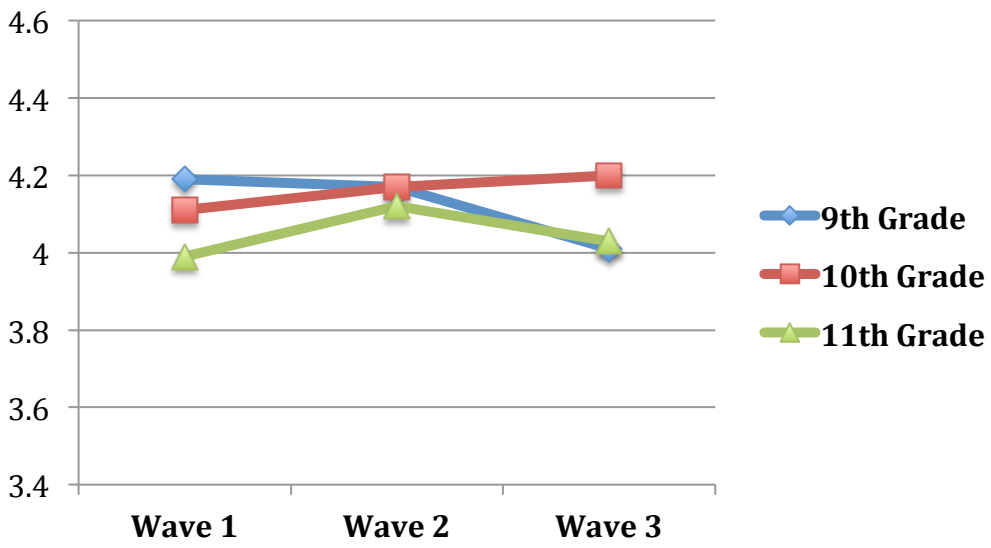


Figure 4.7 Mean Social Mastery Goals Across the School Year by Grade Level

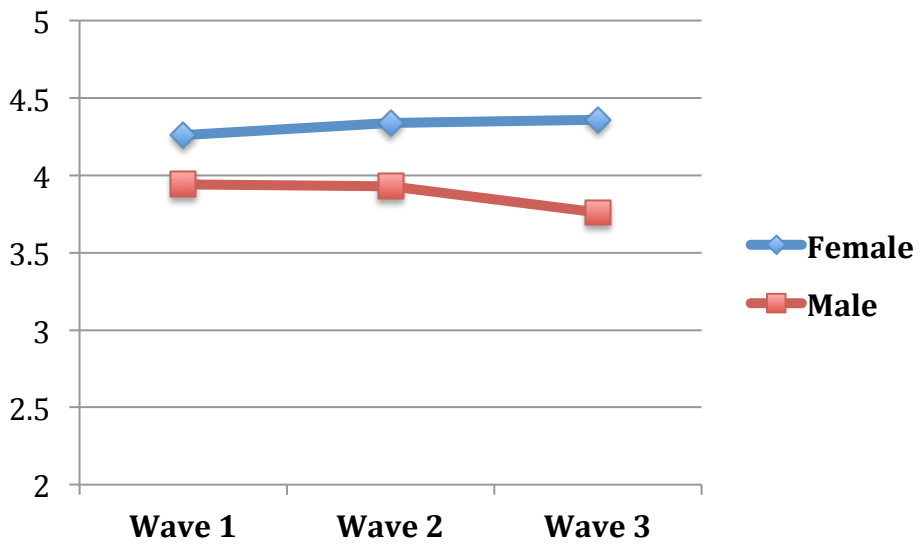


Figure 4.8 Mean Social Mastery Goals Across the School Year by Gender

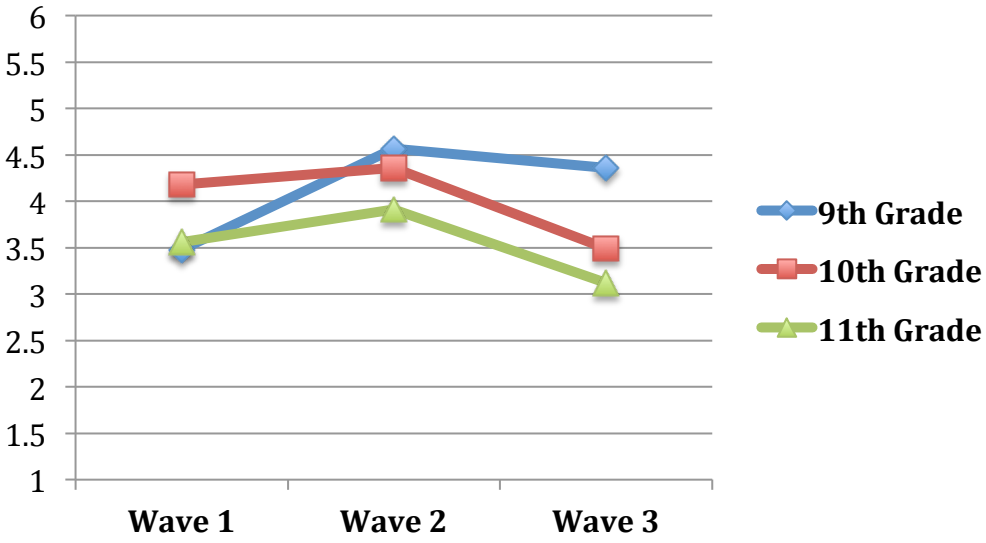


Figure 4.9 Mean Indegree Across the School Year by Grade Level

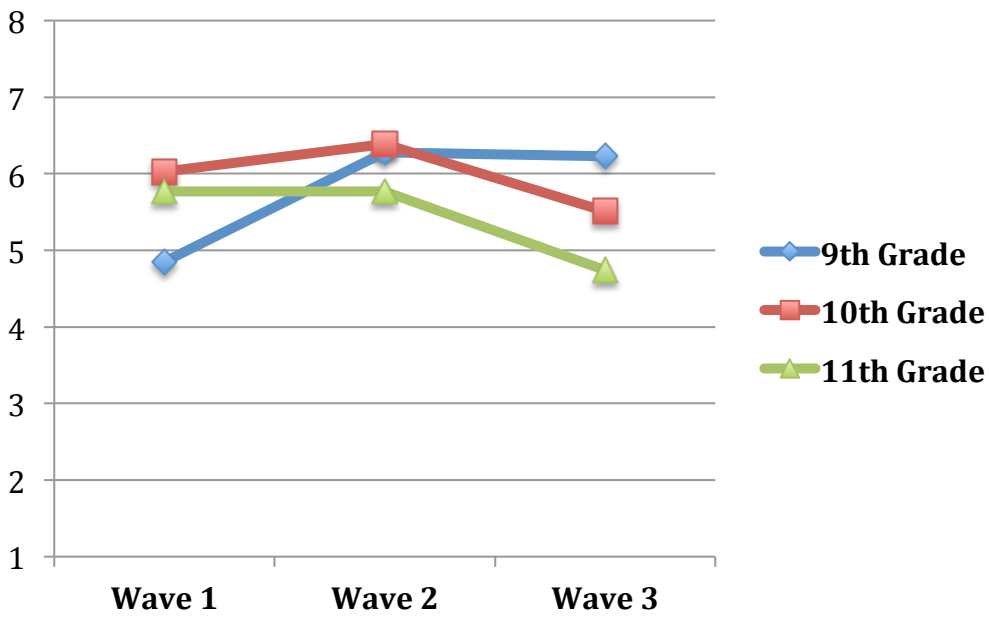


Figure 4.10 Mean Outdegree Across the School Year by Grade Level

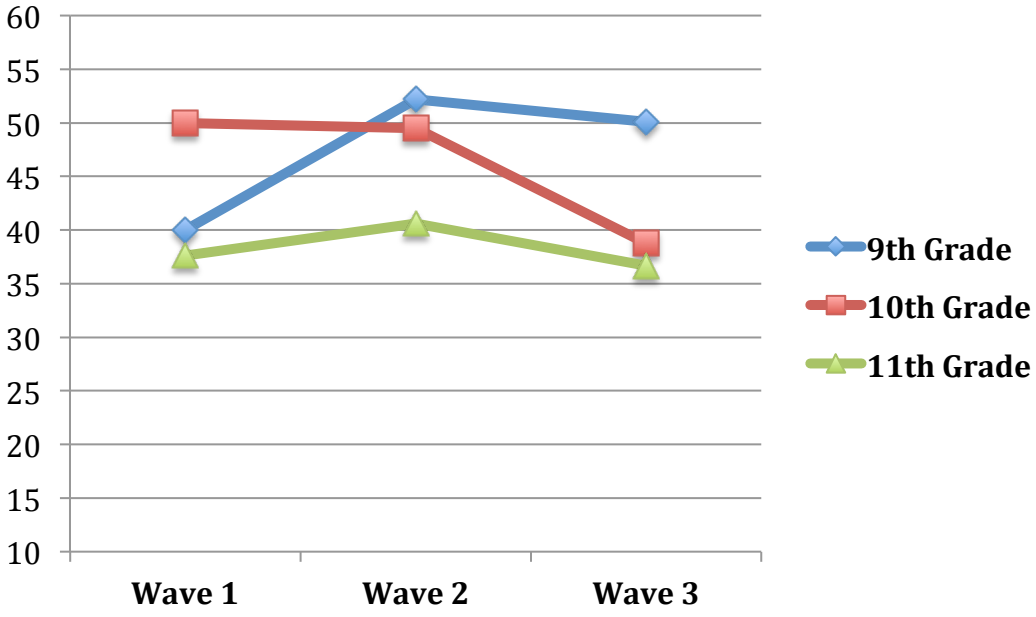


Figure 4.11 Mean Betweenness Across the School Year by Grade Level

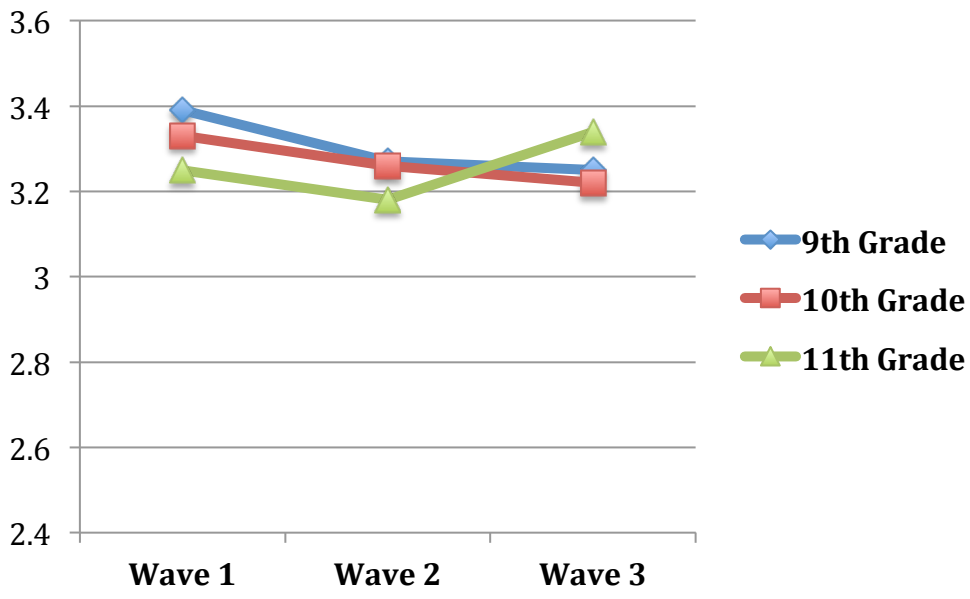


Figure 4.12 Mean GPA Across the School Year by Grade Level

CHAPTER 5

CROSS-LAGGED MODELS OF ACADEMIC GOALS, SOCIAL GOALS, PEER NETWORK POSITION, AND ACADEMIC ACHIEVEMENT

Introduction

The second objective of the dissertation is to determine the relationships and predictive influences between students' academic goals, social goals, peer network position, and academic achievement across the three time points of the school year. The analyses are designed to answer the following research questions: 1) How do academic and social goals predict changes in each other across the year? 2) How do the social network variables relate to academic and social goals across the year? and 3) How do academic goals, social goals, network position, and GPA predict changes in each other across the school year?

In order to address these questions, I conducted a series of six cross-lagged structural equation models (SEM). SEM allows us to test a theoretical proposition about cause and effect without needing to explicitly manipulate variables (Byrne, 2011). It was not possible to include all ten variables into one fully cross-lagged model at three time points due to the extremely high number of parameters to be estimated given the sample size. Furthermore, several models were attempted (not shown) with the three academic goals, three social goals, and/or three social network variables together, and there were several suspected suppression effects due to the high correlation among some of the variables (e.g., performance-approach and –avoidance goals). Given these issues and

restrictions, the appropriate way to address the research questions and was to test six models that 1) focus on one goal orientation at a time (e.g., mastery goals) and 2) focus on one category of network position at a time (local vs. global). Local measures of students' network position were indegree and outdegree and the global measure of network position was betweenness.

Analyses were conducted with Mplus software using the maximum likelihood estimator and Full-Information Maximum Likelihood (FIML) estimation to account for missing data. FIML estimation is considered an appropriate technique to address missing values compared to mean substitution, which can cause biases in standard errors, and listwise deletion, which can cause loss of statistical power (Wothke, 1998). All of the models conducted here included autoregressive paths, cross-lagged paths, and covariances among variables within the same wave. Variables were treated as observed rather than latent. A sample of an a priori full model that was tested is shown in Figure 5.1. The fit indices used to evaluate the overall fit of the model included the comparative fit index (CFI), the Tucker–Lewis Index (TLI), the Standardized Root Mean Square Residual (SRMR), and the root mean square error of approximation (RMSEA). Typically a good fitting model would include the following cut-off scores: CFI > .95, TLI > .95, SRMR < .08, and RMSEA < .06 (Hu & Bentler, 1999). It should be noted that both TLI and RMSEA have a penalty for complex models, and models with low DF can have artificially large RMSEA scores.

All models were run with all paths included, and then were estimated a second time with non-significant paths removed (referred to as the parsimonious model). The $\chi 2$ difference test was used to determine whether the nested model would be preferred;

specifically, a significant difference implies that the model with all paths is preferred, or else the more parsimonious model is preferred. After reporting the path diagrams and findings, the final model cross-lagged paths are compared with the zero-order cross-wave correlation matrices reported in Chapter 4 to check for possible suppression effects due to some of the remaining moderate correlations between the goals (for example, between academic performance-approach and social performance-approach). If a path that was not significant becomes significant in the model or changes direction then it will be reported as due to possible suppression. If the path remains significant and the only difference is a change in the strength of the coefficient then it will not be reported.

Model 1. Mastery Goals, Local Network Position, and Academic Achievement

The cross-lagged SEM included measures of academic mastery goals, social mastery goals, indegree, outdegree, and GPA at all three waves. The full model had an acceptable fit according to CFI and SRMR, although TLI and RMSEA were poor, $\chi 2(25, n = 851) = 225.88$, CFI = .97, TLI = .87, RMSEA = .10, SRMR = .02. The parsimonious model had better fit across the indices ($\chi 2(57, n = 851) = 271.70$, CFI = .96, TLI = .94, RMSEA = .07, SRMR = .04) and did not significantly differ from the full model ($\Delta\chi 2 = 45.82$, $\Delta df = 32$, ns); thus the parsimonious model is used as the final model. The fit indices are shown in Table 5.1.

The path model with estimated standardized coefficients and variance explained in the endogenous variables is shown in Figure 5.2. All variables showed significant stability from W1 to W2 and W2 to W3. Among the goals, there were no cross-lagged relationships between W1 and W2, although between W2 and W3 both academic mastery and social mastery goals predicted positive changes in each other. Between goals and

social network measures, indegree predicted a positive change in social mastery goals at W2, and social mastery predicted a positive change in indegree at W3, while academic mastery did not predict nor was it predicted by indegree or outdegree. Among goals and GPA, GPA positively predicted change in both academic mastery and social mastery at W2, while social mastery goals positively predicted change in GPA at W3. The social network variables of indegree and outdegree positively predicted changes in each other from W1 to W2, while indegree positively predicted change in outdegree from W2 to W3. Finally, among network position and GPA, GPA served as a predictor, positively predicting change in indegree at W2 and W3, as well as positively predicting outdegree at W3. Comparing the standardized coefficients to the zero-order correlation coefficients between W1, W2, and W3 does not suggest the presence of suppression effects.

Model 2. Mastery Goals, Global Network Position, and Academic Achievement

The cross-lagged SEM included measures of academic mastery goals, social mastery goals, betweenness, and GPA at all three waves. The full model had an acceptable fit according to CFI and SRMR, although TLI and RMSEA were poor, $\chi2(16, n = 851) = 208.54$, CFI = .95, TLI = .83, RMSEA = .12, SRMR = .03. The parsimonious model had better fit across the indices ($\chi2(33, n = 851) = 230.62$, CFI = .95, TLI = .91, RMSEA = .08, SRMR = .04) and did not significantly differ from the full model ($\Delta\chi2 = 22.08$, $\Delta df = 17$, ns), thus the parsimonious model is used as the final model. The fit indices are shown in Table X.

The path model with estimated standardized coefficients and variance explained in the endogenous variables is shown in Figure 5.3. All variables showed significant stability from W1 to W2 and W2 to W3. The relationship among the goals is no different

from the previous model. Regarding the relationship between goals and social network measures, social mastery and betweenness positively predicted change in each other from W1 to W2, although they did not from W2 to W3. Between goals and GPA, GPA positively predicted change in academic mastery from W1 to W2, and positively predicted change in social mastery at both W2 and W3. Finally, between network position and GPA, GPA positively predicted change in betweenness at both W2 and W3, while betweenness did not predict change in GPA. There does not appear to be any concern for suppression effects when comparing the standardized coefficients to the zero-order correlation coefficients between W1, W2, and W3.

Model 3. Performance-Approach Goals, Local Network Position, and Academic Achievement

The cross-lagged SEM included measures of academic performance-approach goals, social performance-approach goals, indegree, outdegree, and GPA at all three waves. The full model had an acceptable fit according to CFI and SRMR, although TLI and RMSEA were poor, $\chi2(25, n = 851) = 233.89$, CFI = .96, TLI = .86, RMSEA = .10, SRMR = .02. The parsimonious model had better fit across the indices ($\chi2(59, n = 851) = 278.94$, CFI = .96, TLI = .94, RMSEA = .07, SRMR = .03) and did not significantly differ from the full model ($\Delta\chi2 = 45.05$, $\Delta df = 34$, ns), thus the parsimonious model is used as the final model. The final chi-square and fit indices are shown in Table X.

The path model with estimated standardized coefficients and variance explained in the endogenous variables is shown in Figure 5.4. All variables showed significant stability from W1 to W2 and W2 to W3. Regarding the relationship between the goals, in contrast to the mastery goal models in which the goals suggested an impact on each other

in the first half of the year, academic performance-approach and social performance-approach positively predicted change in each other from W2 to W3, the second half of the year. Regarding goals and network position, academic performance-approach goals had no relationship with indegree or outdegree, while social performance-approach goals positively predicted change in outdegree from W1 to W2. Among the network variables, indegree positively predicted change in outdegree at both W2 and W3, while outdegree positively predicted change in indegree at W2. GPA was a strong predictor again, positively predicting change in academic performance-approach and indegree at W2 and negatively predicting social performance-approach goals at W2. At the end of the year, GPA positively predicted change in indegree and outdegree, and academic performance-approach goals positively but weakly predicted change in GPA. There does not appear to be any concern for suppression effects when comparing the standardized coefficients to the zero-order correlation coefficients between W1, W2, and W3.

Model 4. Performance-Approach Goals, Global Network Position, and Academic Achievement

The cross-lagged SEM included measures of academic performance-approach goals, social performance-approach goals, betweenness, and GPA at all three waves. The full model had an acceptable fit according to CFI and SRMR, although TLI and RMSEA were poor, $\chi 2(16, n = 851) = 198.10$, CFI = .96, TLI = .84, RMSEA = .12, SRMR = .03. The parsimonious model had better fit across the indices ($\chi 2(33, n = 851) = 208.68$, CFI = .96, TLI = .92, RMSEA = .08, SRMR = .03) and did not significantly differ from the full model ($\Delta\chi 2 = 10.58$, $\Delta df = 17$, ns), thus the parsimonious model is used. The final chi-square and fit indices are shown in Table X.

The path model with estimated standardized coefficients and variance explained in the endogenous variables is shown in Figure 5.5. All variables showed significant stability from W1 to W2 and W2 to W3. Again W2 to W3 academic performance-approach and social performance-approach positively predicted change in each other. There was only one cross-lagged relationship between goals and global network position; social performance-approach goals positively predicted change in W2 betweenness. Between goals and GPA, GPA positively predicted change in W2 academic performance-approach and negatively predicted change in W2 social performance-avoidance, while academic performance-approach positively predicted change in W3 GPA. Finally, GPA positively predicted change in betweenness at both W2 and W3, and betweenness also positively predicted change in GPA at W3. There does not appear to be any concern for suppression effects.

Model 5. Performance-Avoidance Goals, Local Network Position, and Academic Achievement

The cross-lagged SEM included measures of academic performance-avoidance goals, social performance-avoidance goals, indegree, outdegree, and GPA at all three waves. The full model had an acceptable fit, although TLI and RMSEA were poor, $\chi 2(25, n = 851) = 245.34$, CFI = .96, TLI = .85, RMSEA = .10, SRMR = .02. The parsimonious model had better fit across the indices ($\chi 2(60, n = 851) = 294.94$, CFI = .96, TLI = .93, RMSEA = .07, SRMR = .04) and did not significantly differ from the full model ($\Delta\chi 2 = 49.60$, $\Delta df = 35$, ns), thus the parsimonious model is used. The final chi-square and fit indices are shown in Table X.

The path model with estimated standardized coefficients and variance explained

in the endogenous variables is shown in Figure 5.6. All variables showed significant stability from W1 to W2 and W2 to W3. Regarding the relationships among the goals, social performance-avoidance positively predicted change in academic performance-avoidance at both W2 and W3, and academic performance-avoidance predicted positive change in social performance-avoidance at W3. While the goals did not predict indegree or outdegree, indegree negatively predicted change in social performance-avoidance goals at W2 and W3. Outdegree positively predicted change in indegree at W2, and indegree positively predicted change in outdegree at W2 and W3. Regarding goals and GPA, there were two findings but they are possible issues of suppression so they should be interpreted with caution. The path from W2 GPA to W3 social performance-avoidance was non-significant in the zero-order correlations ($r = .03$, ns) and is significant in the model ($r = .08$, $p < .05$). Furthermore, the path from W2 academic performance-avoidance to W3 GPA was non-significant in the zero-order correlations ($r = -.03$, ns) and has a small positive relationship in the model ($r = .04$, $p < .05$). Finally, regarding local network position, GPA predicted positive change in W2 and W3 indegree, as well as a positive change in W3 outdegree.

Model 6. Performance-Avoidance Goals, Global Network Position, and Academic Achievement

The cross-lagged model included measures of academic performance-avoidance goals, social performance-avoidance goals, betweenness, and GPA at all three waves. The full model had an acceptable fit, although TLI and RMSEA were poor, $\chi2(16, n = 851) = 213.55$, CFI = .95, TLI = .81, RMSEA = .12, SRMR = .03. The parsimonious model had better fit across the indices ($\chi2(34, n = 851) = 237.69$, CFI = .95, TLI = .91,

RMSEA = .08, SRMR = .04) and did not significantly differ from the full model ($\Delta\chi 2$ = 24.14, Δdf = 18, ns), thus the parsimonious model is used. The final chi-square and fit indices are shown in Table X.

The path model with estimated standardized coefficients and variance explained in the endogenous variables is shown in Figure 5.7. As before, all variables showed significant stability from W1 to W2 and W2 to W3. The same relationships among the goals as in Model 5 held true. There were no cross-lagged relationships between the goals and betweenness. Regarding goals and academic achievement, GPA positively predicted change in W3 social performance-avoidance, while academic performance-avoidance positively predicted change in W3 GPA. Finally, GPA positively predicted change in betweenness at both W2 and W3, and betweenness positively predicted change in GPA at W3. There does not appear to be any concern for suppression effects.

Conclusion

In order to provide a summary of the findings, each set of variables (academic goals, social goals, network position, GPA) will be presented successively in terms of how they predicted change in the other variables across the school year.

Academic Goals

Academic goals matter for social goals and GPA. Academic goals predicted positive change in their parallel social goals, but only from the middle to the end of the school year. For example, students' academic mastery goals positively predicted their end of year social mastery goals, controlling for past levels of social mastery and allowing past academic mastery and social mastery to covary. In other words, students whose goal is to develop their understanding of the curricular material increased in their goal to have

high quality relationships with others at school. However, students' academic goals did not predict changes in their social network position over time. It may be that social goals mediate the relationship between the two, or that more time is required for the development of any significant relationship between the two. Finally, in predicting academic achievement, students' academic performance-approach goals positively yet weakly predicted change in GPA, while mastery and performance-avoidance goals did not. Given the stability in GPA, however, and the fact that other variables were simultaneously explaining some of the variance in GPA, it could be considered a substantive effect.

Social Goals

Social goals mattered for academic goals, social network position, and for GPA. Social goals positively predicted change in academic goals, primarily in the second half of the year although performance-avoidance was predicted at both time points. In contrast to academic goals, social goals predicted students' social network position. Students with social mastery goals increased in their betweenness in the school social network during the first half of the year, and increased in the number of peer nominations they received in the second half of the year. Social performance-approach goals were also beneficial for students' betweenness as well as how many peers they named, while social performance-avoidance goals had no impact on network position. Finally, social mastery goals positively predicted end of the year GPA, while performance-approach and performance–avoidance were not predictive of GPA. In other words, students who have a goal to have high quality relationships with others evidenced an increase in their GPA, while those who had goals to be popular or avoid being unpopular did not predict changes in their

school performance.

Social Network Position

Students' social network position mattered for their social goals and their GPA. Just as academic goals did not predict network position, network position also did not predict change in academic goals. However, social network position did predict change in social goals. Students' indegree (the number of nominations received) and their betweenness in the social network positively predicted their social mastery goals, while outdegree (number of peers listed) did not predict any social goals. The number of nominations a student received also led to a decrease in their social performance-avoidance goals in the first half of the year. Regarding academic achievement, students' global network position, their betweenness, positively predicted an increase in their GPA in 2/3 betweenness models, while students' local network position measures (indegree and outdegree) did not.

Academic Achievement

Typically, academic achievement is the outcome in models of motivation and peer relationships, but within these models it was one of the most prominent predictors. Students' GPA predicted changes in their academic goals, social goals, and social network position. Regarding academic goals, students with higher academic achievement had an increase in their academic mastery and academic performance-approach goals in the first half of the year, while GPA had no relationship with academic performance-avoidance goals. Students' with higher academic achievement also had an increase in their social mastery goals across the year, social performance-avoidance goals in the second half of the year, and had a decrease in their social performance-approach goals.

Finally, GPA positively predicted both global and local measures of students' network position. In other words, students with higher academic achievement increased in the number of peers they listed, in the number of peers who nominated them, and in their betweenness in the peer social network of the high school.

Chapter 5 References

Byrne, B. M. (2011). *Structural Equation Modeling with MPlus: Basic Concepts, Applications, and Programming*. New York: Routledge.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1−55.

Raykov, T. (2005). Analysis of longitudinal studies with missing data using covariance structure modeling with full-information maximum likelihood. *Structural Equation Modeling, 3*, 493−505.

Table 5.1 Cross-Lagged Structural Equation Models

	$\chi 2$	DF	CFI	TLI	RMSEA	SRMR
Mastery, Local	271.70	57	.96	.94	.07	.04
Mastery, Global	230.62	33	.95	.91	.08	.04
Perf-App, Local	278.94	59	.96	.94	.07	.03
Perf-App, Global	208.68	33	.96	.92	.08	.03
Perf-Avoid, Local	294.94	60	.96	.93	.07	.04
Perf-Avoid, Global	237.69	34	.95	.91	.08	.04

Note. DF = degrees of freedom, CFI = Comparative fit index, TLI = Tucker-Lewis Index, SRMR = Standardized root mean square residual, RMSEA = Root mean square error of approximation

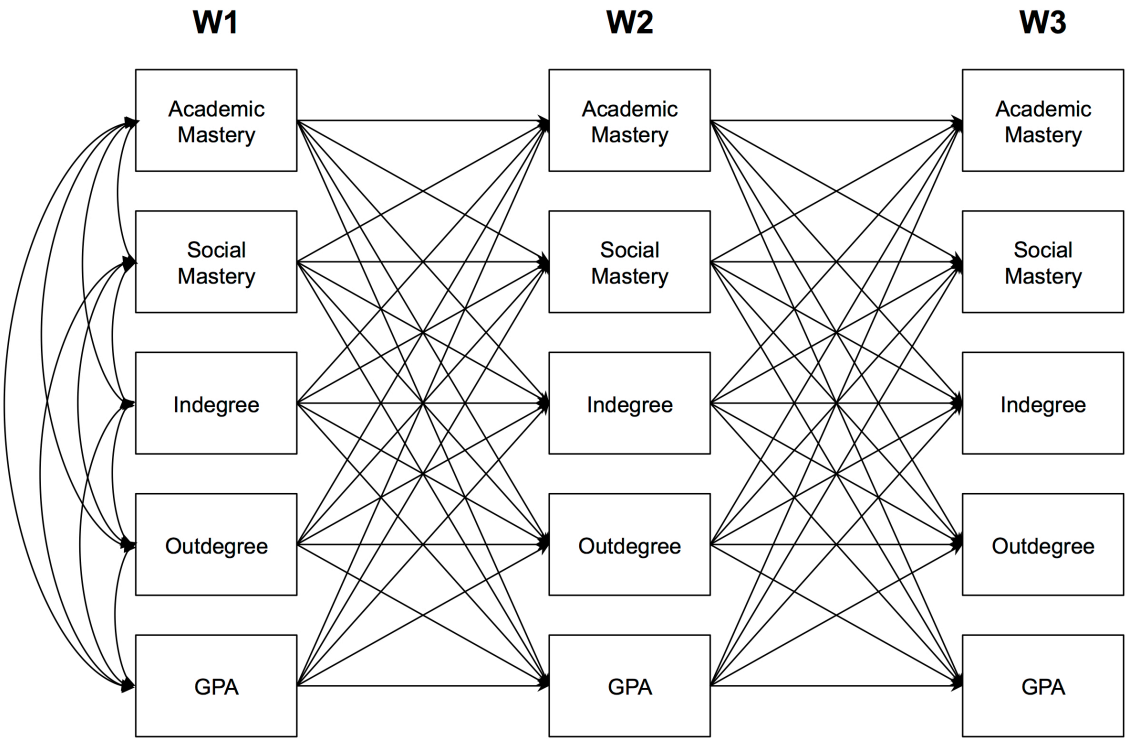


Figure 5.1 Planned Cross-Lagged SEM Model

Note. The variables were allowed to covary at all three waves to account for concurrent relations; however, only the initial correlations are displayed in the path diagram.

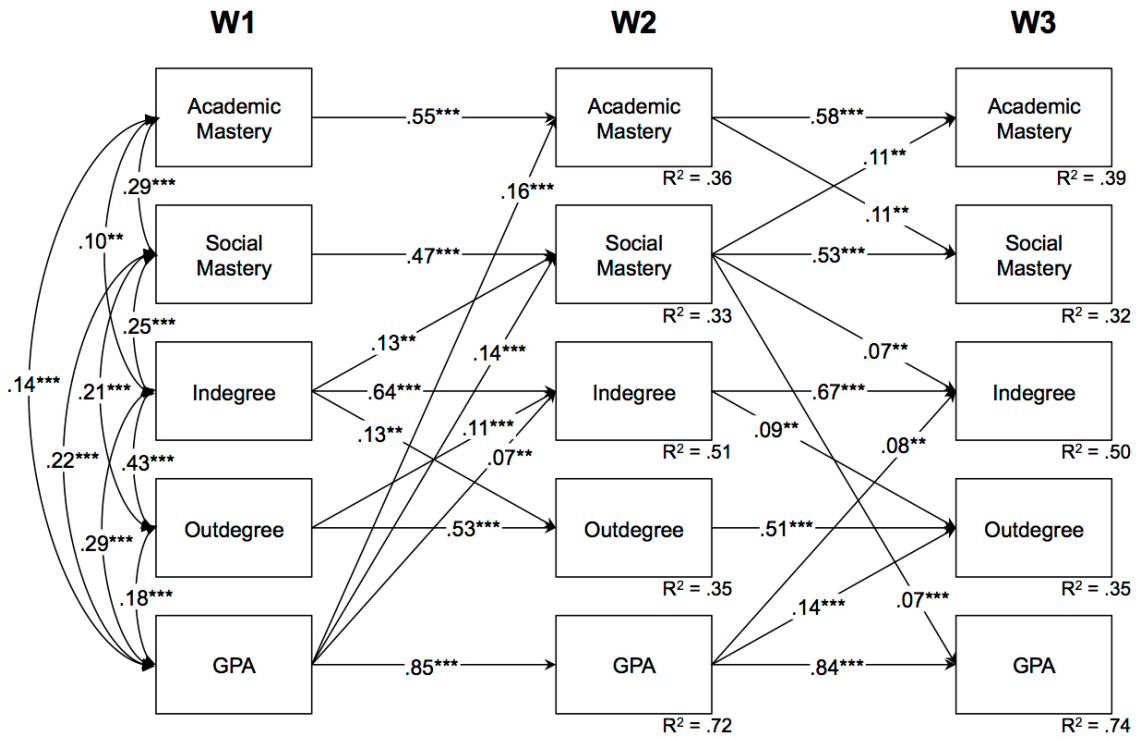


Figure 5.2 SEM of Mastery Goals, Local Network Position, and Academic Achievement

Note. Standardized coefficients are shown. The variables were allowed to covary at all three waves to account for concurrent relations; however, only the initial correlations are displayed in the path diagram. R^2 is the estimated proportion of explained variance. * $p <$ .05, ** $p <$ .01, *** $p <$ .001

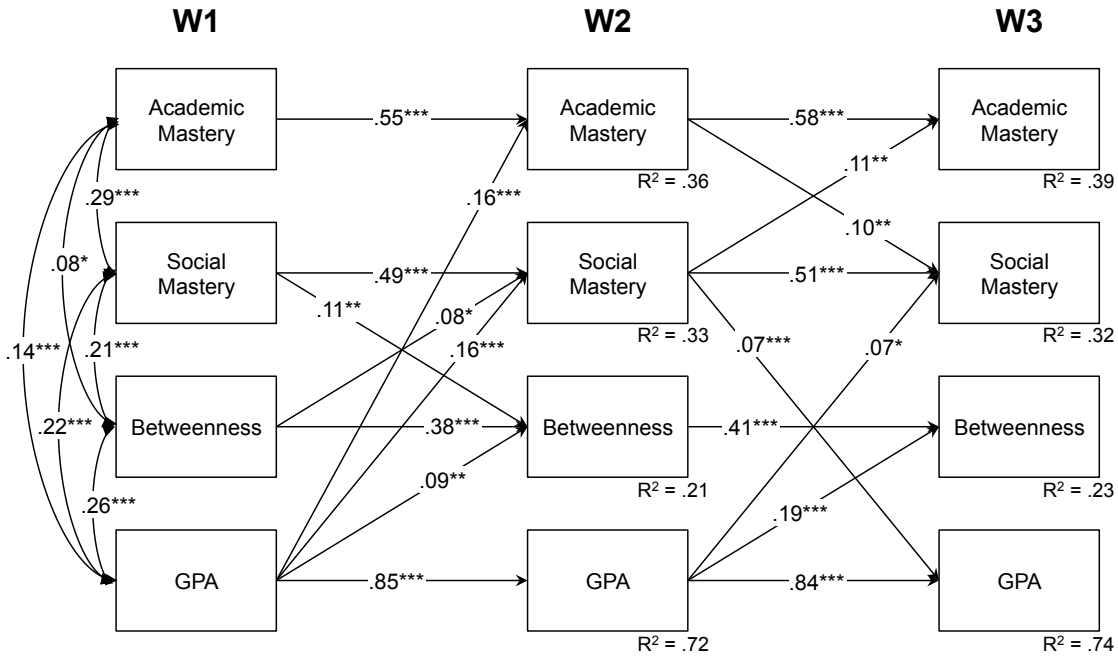


Figure 5.3 SEM of Mastery Goals, Global Network Position, and Academic Achievement

Note. Standardized coefficients are shown. The variables were allowed to covary at all three waves to account for concurrent relations; however, only the initial correlations are displayed in the path diagram. R^2 is the estimated proportion of explained variance. * $p <$ .05, ** $p < .01$, *** $p < .001$

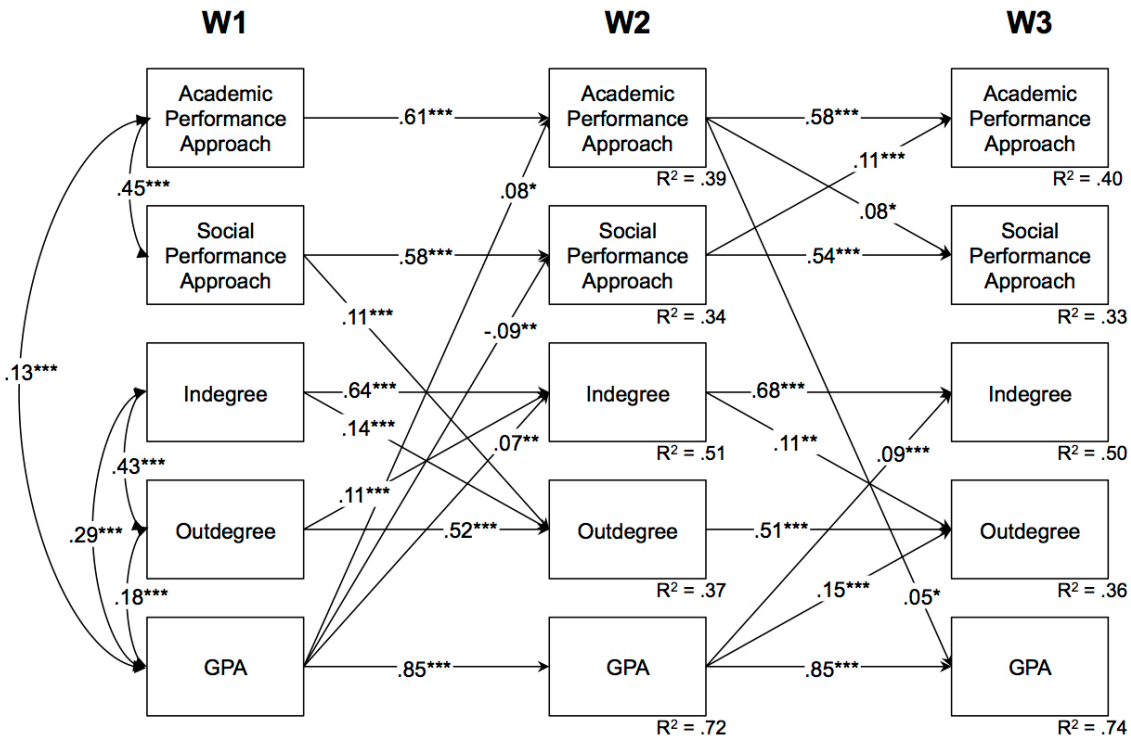


Figure 5.4 SEM of Performance-Approach Goals, Local Network Position, and Academic Achievement

Note. Standardized coefficients are shown. The variables were allowed to covary at all three waves to account for concurrent relations; however, only the initial correlations are displayed in the path diagram. R^2 is the estimated proportion of explained variance. * $p <$ .05, ** $p <$ .01, *** $p <$ .001

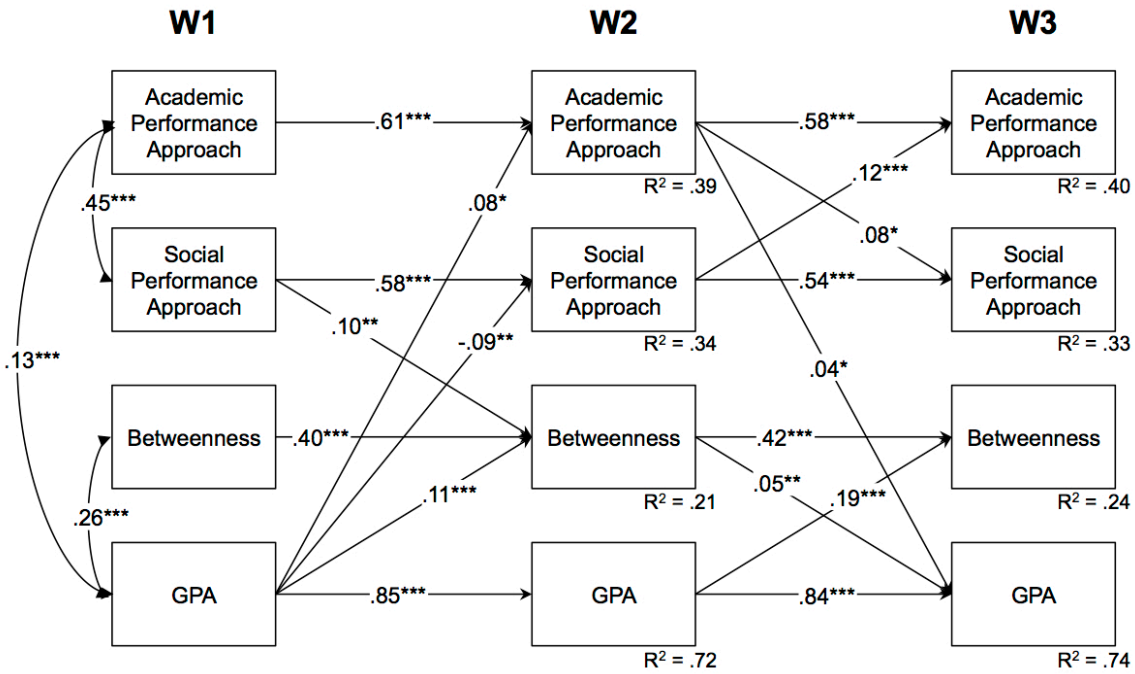


Figure 5.5 SEM of Performance-Approach Goals, Global Network Position, and Academic Achievement

Note. Standardized coefficients are shown. The variables were allowed to covary at all three waves to account for concurrent relations; however, only the initial correlations are displayed in the path diagram. R^2 is the estimated proportion of explained variance. * $p <$ .05, ** $p <$ .01, *** $p <$ .001

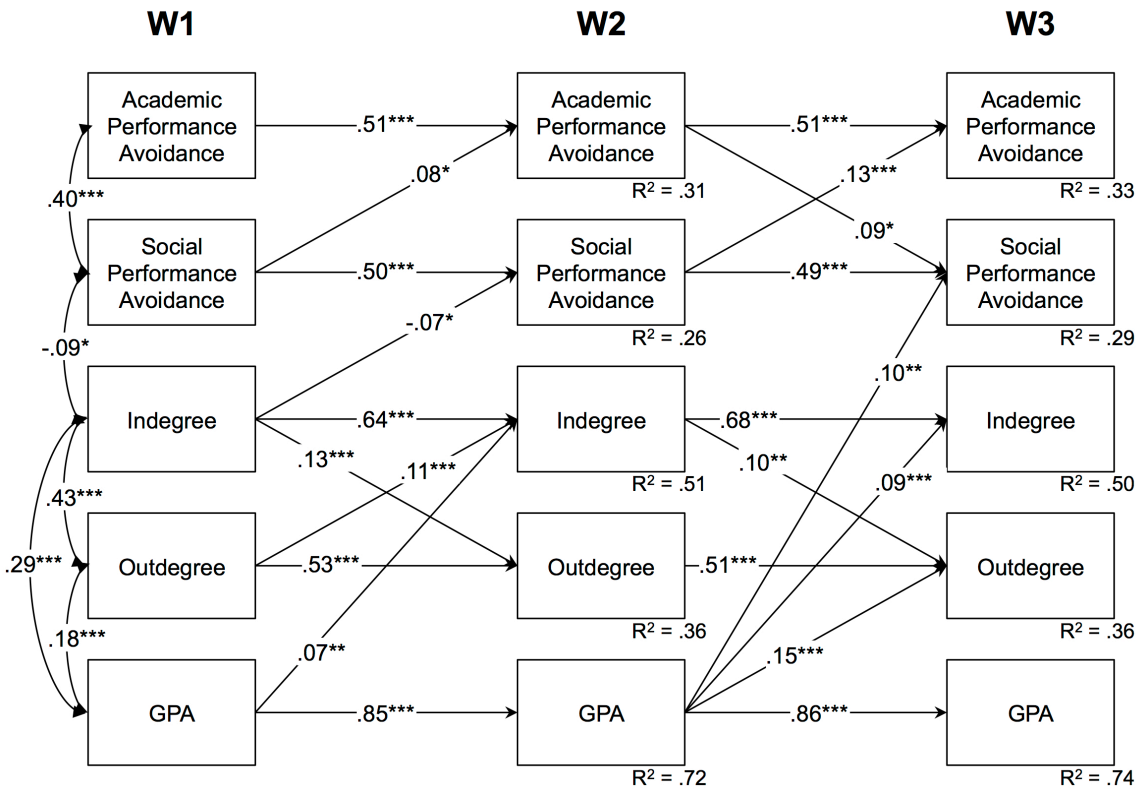


Figure 5.6 SEM of Performance-Avoidance Goals, Local Network Position, and Academic Achievement

Note. Standardized coefficients are shown. The variables were allowed to covary at all three waves to account for concurrent relations; however, only the initial correlations are displayed in the path diagram. R^2 is the estimated proportion of explained variance. * $p <$ .05, ** $p <$ .01, *** $p <$ .001

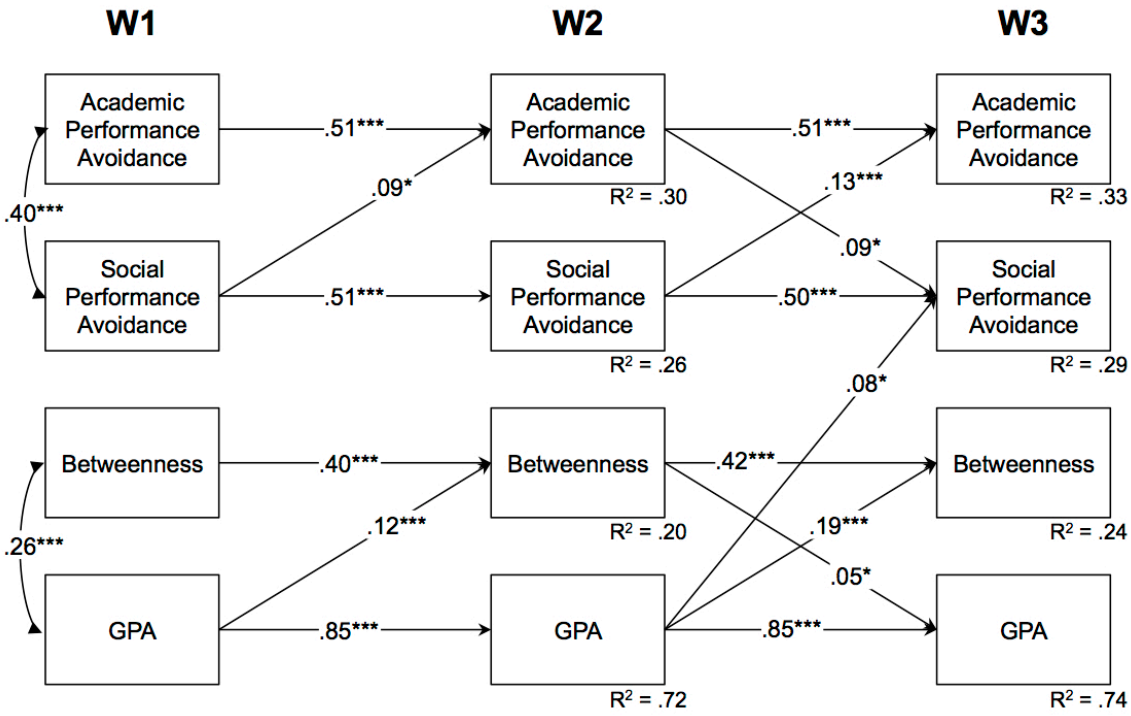


Figure 5.7 SEM of Performance-Avoidance Goals, Global Network Position, and Academic Achievement

Note. Standardized coefficients are shown. The variables were allowed to covary at all three waves to account for concurrent relations; however, only the initial correlations are displayed in the path diagram. R^2 is the estimated proportion of explained variance. * $p <$ .05, ** $p < .01$, *** $p < .001$

CHAPTER 6

THE IMPACT OF PEERS' GOALS AND ACHIEVEMENT ON STUDENTS' GOALS AND ACHIEVEMENT

This chapter is divided into five sections to address the following questions: 1) How do students' academic goals (mastery, performance-approach, and performance-avoidance) and social goals (mastery, performance-approach, and performance-avoidance) predict changes in each other across the school year? 2) How do the social network variables (measures of students' position in the peer social network), academic goals, and social goals predict changes in each other across the year? and 3) How do students' academic goals, social goals, network position, and academic achievement (i.e., GPA) predict changes in each other across the school year?

It is important to note that this chapter focuses on the peers that are directly connected to each student (their incoming and outgoing peer nominations, i.e., their indegree and outdegree). Therefore students who did not list or receive any peer nominations cannot be included within the analyses. Furthermore, some students may have listed a few students as friends or received some nominations, but if the students whom they are connected to do not have permission then they are also not included in our analysis since there is no data for their peers' academic and social goals. Thus the sample sizes for this chapter are lower than for analyses conducted in previous chapters. It is also noteworthy that throughout this section, analysis are not focusing on students' report of

their peers' academic and social goals, but rather this is using the actual levels of goals reported by students' peers to predict their own goals and achievement.

UCINet software was used to calculate the levels of peers' academic goals, social goals, and GPA. UCINet has an option called "Ego Network" that can be used to calculate the average on some characteristic of all of the directly linked peers that nominated the target student (incoming peers) and the average on some characteristic of all of the directly linked peers that were nominated by the target student (outgoing peers). Therefore, I calculated the average incoming and outgoing peers' score on each academic and social goal. I calculated it separately for each survey wave since students may have changed friends throughout the year. For example, for the social mastery variable, I ended up with W1, W2, and W3 average scores of outgoing peers' social mastery and W1, W2, and W3 average scores of incoming peers' social mastery. This was conducted for all six goals and GPA.

Due to the high correlation between academic performance-approach and –avoidance, and social performance-approach and –avoidance, suppression could be an issue since the peers' values of these are simultaneously entered as predictors in the models below. In order to determine whether the results changed in any meaningful way (i.e. any significant predictors becoming insignificant or vice versa, any significant negative predictors becoming positive or vice versa, etc.), all of the models within this chapter were re-run without peers' academic or social performance-approach goals and then without peers' academic or social performance-avoidance goals. The results are included in the text.

Peers' Academic Goals as Predictors of Students' Academic Goals

The first set of analyses focus on describing how the academic goals of the peers that students regularly hang out with predict changes in students' own academic goals. I ran 6 different regressions—predicting each of the three goals with both incoming peers' average academic goals and outgoing peers' average academic goals. As a reminder, incoming peer levels are the average level of the peers who nominated the student as someone they regularly hang out with, while outgoing peer levels are the average level of the peers who were *nominated by* the student. These may be different, since students may not report the same peers who report them for various reasons—wanting to hang out vs. actually hanging out, forgetting to list someone, one side not feeling as connected as the other, etc. Critical to the analysis is the inclusion of past value of the students' goal as a predictor in order to examine change.

First I ran a multiple regression predicting students' end of the year academic mastery goals. The incoming peer model was significant, $F(4,546) = 33.73$, $p < .001$, $R^2 = .20$. The outgoing peer model was also significant, $F(4,541) = 38.13$, $p < .001$, $R^2 = .22$. As shown in Table 6.1, students' past academic mastery goals predicted their end of the year academic mastery goals as expected. Additionally, average incoming and outgoing peer levels of academic mastery goals positively predicted change in students' own academic mastery goals across the school year. Second I ran a multiple regression predicting change in students' academic performance-approach goals. The incoming peer model was significant, $F(4,544) = 53.32$, $p < .001$, $R^2 = .28$. The outgoing peer model was also significant, $F(4,539) = 51.16$, $p < .001$, $R^2 = .28$. As shown in Table 6.1, besides the expected prediction of students' past academic performance-approach goals, no peer level academic goals predicted changes in students' academic performance-approach.

Third, I ran a multiple regression predicting change in students' academic performance-avoidance goals. The incoming peer model was significant, $F(4,547) = 36.11$, $p < .001$, $R^2 = .21$. The outgoing model was also significant, $F(4,542) = 36.35$, $p < .001$, $R^2 = .21$. Besides the expected prediction of students' past performance-avoidance goals, no peer level academic goals predicted changes in students' academic performance-avoidance.

Due to the high correlation between academic performance-approach and –avoidance, all six regression models (as shown in Table 6.1) were re-run, first without peers' academic performance-approach and then second without peers' academic performance-avoidance. The results did not change in any meaningful way (i.e. no significant predictors became insignificant or vice versa, and no significant negative predictors became positive or vice versa).

All of the variables were in the expected direction, but unfortunately the peer levels of performance goals were not significant in predicting students' performance goals. Several of the results were marginally significant, for example, when predicting change in students' academic performance-avoidance goals, peer levels of academic performance-avoidance goals were marginally positive significant predictors at $p < .10$. Perhaps more time is needed in order to gather significant effects of peer levels of motivation on students' own motivation, especially since their motivation is so stable as indicated by the high beta coefficients for W1 goals predicting W3 goals. Comparing the incoming vs. outgoing peer models, the models generally explain the same amount of variance and the same predictors are significant across both, suggesting that it does not really matter whether you are looking at the academic goal levels of the peers who nominated a student vs. the peers whom received nominations from a student.

Peers' Social Goals as Predictors of Students' Social Goals

The second set of analyses focus on describing how the social goals of the peers that students regularly hang out with predict changes in students' own social goals. Again I ran six regression models—predicting each of the three social goals with both incoming peers' average social goals and outgoing peers' average social goals.

First I ran a multiple regression predicting students' end of the year social mastery goals. The incoming peer model was significant, $F(4,548) = 47.68$, $p < .001$, $R^2 = .26$. The outgoing peer model was also significant, $F(4,544) = 51.73$, $p < .001$, $R^2 = .28$. As shown in Table 6.2, students' past social mastery goals predicting their end of the year academic mastery goals as expected. Additionally, their average incoming and outgoing peer levels of social mastery goals positively predicted change in their own social mastery goals across the school year. Second I ran a multiple regression predicting change in students' social performance-approach goals. The incoming peer model was significant, $F(4,549) = 38.74$, $p < .001$, $R^2 = .22$. The outgoing peer model was also significant, $F(4,544) = 38.53$, $p < .001$, $R^2 = .22$. As shown in Table 6.2, students' past social performance-approach goals positive predicted their end of year social performance-approach goals. Furthermore, outgoing (but not incoming) peer levels of social performance-approach goals positively predicted change in students' own performance-approach goals across the school year. Third, I ran a multiple regression predicting change in students' social performance-avoidance goals. The incoming peer model was significant, $F(4,549) = 27.37$, $p < .001$, $R^2 = .17$. The outgoing peer model was also significant, $F(4,544) = 29.54$, $p < .001$, $R^2 = .18$. As shown in Table 6.2, students' past social performance-avoidance goals were positive predictors as expected.

Similar to the previous models, outgoing (but not incoming) peer levels of social performance-avoidance goals positively predicted change in students' own performance-avoidance goals across the school year.

Due to the high correlation between social performance-approach and –avoidance, all six regression models (as shown in Table 6.2) were re-run, first without peers' social performance-approach and then second without peers' social performance-avoidance. The results did not change in any meaningful way (i.e. no significant predictors became insignificant or vice versa, and no significant negative predictors became positive or vice versa).

In all models, peers' social goals matter to a small degree for predicting change in students' own social goals across the school year. For social mastery goals, both incoming and outgoing peer levels predicted students own social mastery goals at the end of the year. However, for performance-approach and –avoidance goals, only outgoing peer levels predicted change in students' performance goals. It could be that students who are performance oriented are more focused on whom they think they are connected to (outgoing peers) rather than whom is connected to them (incoming peers), and thus their perceptions of whom they are hanging out with matter more for their own goals. It is noteworthy that in all of these models, more time may be needed in order to see significant effects of peer levels of motivation on students' own social motivation, especially since their motivation is so stable across the school year.

Peers' Academic and Social Goals as Predictors of Students' GPA

The third set of analyses in this chapter focus on predicting students' GPA with levels of friends' academic and social goals. In the previous chapter I learned that GPA is

very stable across the school year. Therefore in the first set of models I will only predict end of the year GPA without controlling for beginning of the year GPA. Then I will run a second set of models controlling for beginning of the year GPA. Both academic and social goals of students' incoming and outgoing peers will be entered as predictors in separate models.

First I ran a multiple regression predicting students' end of the year GPA with students' beginning of the year peers' academic and social goals. The incoming peer model was significant, $F(6,713) = 16.10$, $p < .001$, $R^2 = .12$. The outgoing peer model was also significant, $F(6,625) = 13.23$, $p < .001$, $R^2 = .11$. As shown in Table 6.3, in the incoming peer model, peers' level of academic performance-approach goals and social mastery goals positively predicted students' end of the year GPA, while peers' academic performance-avoidance goals negatively predicted end of the year GPA. In the outgoing peer model, peers' academic performance-approach, social mastery, and social performance-avoidance positively predicted students' end of the year GPA, while peers' academic performance-avoidance and peers' social performance-approach negatively predicted students' end of the year GPA. An interesting finding here is that performance-approach is beneficial for GPA when it is within the academic domain (wanting to demonstrate competence academically) but is it harmful for GPA when it is within the social domain (wanting to demonstrate competence socially). In the reverse manner, performance-avoidance is beneficial for GPA when it is within the social domain (wanting to avoid looking unpopular) and harmful for GPA when it is within the academic domain (wanting to avoid looking not smart). It makes sense—if a student is focused on looking popular they may spend less time on academic or focus less on

academics, whereas if a student is unpopular they may spend more time on academics. Finally, it is noteworthy that peers' academic and social goals explain 11-12% of the variance in students' end of the year GPA.

Due to the high correlation between academic performance-approach and –avoidance, as well as social performance-approach and –avoidance, the incoming and outgoing models were re-run, excluding one of the potentially problematic variables at a time. When the incoming model was run without academic performance-approach, peers' academic performance-avoidance became insignificant. When the outgoing model was run without academic performance-approach, peers' academic performance-avoidance and social performance-approach remained negative but became insignificant, and without social performance-approach goals and –avoidance goals respectively, peers' social performance-avoidance and –approach goals became insignificant. These paths should therefore be interpreted with caution.

There is a chance that students change some or even all of their peers throughout the school year, thus I wanted to examine whether students' end of the year peers' (W3 rather than W1) academic and social goals predicted students' concurrent end of the year GPA. I expected that concurrent peers' goals should be stronger predictors. Therefore my second set of analyses was multiple regressions predicting students' end of the year GPA with end of the year peers' academic and social goals. The incoming peer model was significant, $F(6,731) = 17.38$, $p < .001$, $R^2 = .13$. The outgoing peer model was also significant, $F(6,599) = 17.85$, $p < .001$, $R^2 = .15$. As shown in Table 6.3, within both incoming and outgoing peer models, W3 peers' academic performance-approach goals, peers' social mastery goals, and peers' social performance-avoidance goals positively

predicted students' W3 GPA, while peers' academic performance-avoidance and peers' social performance-approach negatively predicted students' GPA. There were no drastic differences between W1 peers' goals and W3 peers' goals on students' end of the year GPA, except that most of the W3 peers' goals had slightly stronger coefficients as expected.

Due to the high correlation between academic performance-approach and –avoidance, as well as social performance-approach and –avoidance, the incoming and outgoing models were re-run, excluding one of the potentially problematic variables at a time. Without academic performance-approach, social performance-approach remained negative but insignificant, and when run without academic performance-avoidance, social performance-avoidance remained positive but insignificant. Without academic performance-avoidance and social performance-approach, social performance-avoidance remained positive but became insignificant. These paths should therefore be interpreted with caution.

Third, I ran a multiple regression predicting students' end of the year GPA while controlling for their previous GPA, i.e., predicting change in GPA across the school year. I did not expect many of the peers' goals to be predictive because of the stability of GPA across the school year. The incoming peer model was significant, $F(7,712) = 199.56$, $p < .001$, $R^2 = .66$. The outgoing peer model was also significant, $F(7,624) = 188.61$, $p < .001$, $R^2 = .68$. As shown in Table 6.3, incoming peers' levels of academic and social goals predicted change in students' GPA, while outgoing peers' level of goals did not predict changes in students' GPA. In the incoming peer model, controlling for the strong effect of W1 GPA, I still found that beginning of the year peers' academic performance-

approach goals and peers' social mastery goals positively predict W3 GPA, while peers' social performance-avoidance goals negatively predict W3 GPA.

Due to the high correlation between academic performance-approach and –avoidance, as well as social performance-approach and –avoidance, the incoming and outgoing models were re-run, excluding one of the potentially problematic variables at a time. Without peers' academic performance-approach, academic performance-avoidance became slightly positively significant. Without social performance-approach and –avoidance, academic performance-approach becomes slightly positively significant. These paths should therefore be interpreted with caution.

An important finding within this model is the importance of social goals. As I learned in the previous chapter, social goals, especially social mastery goals, matter for students' academic achievement. Here I found that peers' social goals also mater for achievement, in addition to peers' academic goals. I attempted to model the impact of peers' goals on students' GPA in three different ways, by taking beginning of the year peers' goals, end of the year peers' goals, and controlling for previous GPA in order to examine how peers' goals predict changes in students' GPA. Remarkably given the stability in GPA across the school year I still found that peers' academic and social goals predict change in students' GPA. As in the previous models, social and academic motivations work differently. While peers' social mastery is positively related to students' GPA, peers' mastery in the academic domain did not impact students' GPA.

Peers' GPA as a Predictor of Students' GPA

The fourth set of analyses is examining the impact of peers' GPA on students' GPA. I ran a multiple regression of peers' GPA predicting changes in students' GPA, i.e.,

W3 GPA controlling for W1 GPA. The incoming peer model was significant, $F(2,717) = 664.54$, $p < .001$, $R^2 = .65$. I did not include a table for this set of analyses. In addition to students own W1 GPA predicting their W3 GPA ($\beta = .76$, $p < .001$, their incoming peers' W1 GPA also significantly predicted their W3 GPA ($\beta = .09$, $p < .001$). The outgoing peer model was also significant, $F(2,626) = 663.92$, $p < .001$. In addition to students own W1 GPA predicting their W3 GPA ($\beta = .80$, $p < .001$, their outgoing peers' W1 GPA also significantly predicted their W3 GPA ($\beta = .06$, $p < .05$). In summary, peers' GPA matters for changes in students' GPA, and comparing the standardized coefficients it appears that incoming peers' GPA (the GPA of peers nominate the target student) is a stronger predictor than outgoing peers.

Differences in the Impact of Peers on Students' GPA by Students' Grade Level, Gender, and Race

Due to the large number of models conducted thus far in this chapter, I will focus on demographic differences in one of the most interesting models—the impact of W3 incoming peers' academic and social goals on students' W3 GPA. In other words, how does the average academic and social goals of the peers who nominated the student as someone they regularly hang out with at the end of the year predict that student's end of the year GPA? I chose this model because it had multiple significant predictors and thus would hopefully allow me to view the most differences of the impact of peers' goals between the different demographic groups. The simplest form of comparison is to run separate models for each demographic group. Alternatively, I could add gender, race, and grade level as predictors in the model using dummy codes, but then would need to also create interaction variables with all of the predictors, resulting in a large and possibly

incomprehensible model with a large number of estimated parameters. Therefore I will select populations and repeat the model conducted earlier in this chapter across each of the groups.

In order to compare students' grade levels I ran three consecutive models selecting 9th graders, 10th graders, and 11th graders. The three models are shown in Table 6.4. The 9th grade student model was significant, $F(6,266) = 10.08$, $p < .001$, $R^2 = .19$. Peers' academic performance-approach and social mastery goals positively predicted 9th grade students GPA while peers' academic performance-avoidance goals negatively predicted their GPA. The 10th grade model was significant, $F(6,232) = 9.96$, $p < .001$, $R^2 = .21$. Similar to 9th graders, 10 graders' peers' academic performance-approach and social mastery goals positively predicted GPA while peers' academic performance-avoidance goals negatively predicted GPA. The only difference was that peers' social performance-avoidance goals additionally positively predicted 10th graders GPA. The 11th grade student model was also significant, $F(6,219) = 3.48$, $p < .01$, $R^2 = .09$. Peers' academic performance-avoidance and social performance-approach goals negatively predicted 11th grade students' GPA while peers' social performance-avoidance goals positively predicted students' GPA. It was noteworthy across these models that peers' goals had the least explanatory power in 11th grade (9%), although it is unclear why this would be the case. Furthermore, the impact of peers' social performance-approach goals seems to increase across grade levels, becoming more negatively related to students' GPA, while the impact of peers' academic performance-approach goals seems to decrease across grade levels, become less positively related to students' GPA.

I ran two consecutive models selecting female and male students in order to compare students' gender. The two models are shown in Table 6.5. The female model was significant, $F(6,402) = 11.93$, $p < .001$, $R^2 = .15$. Almost all of peers' academic and social goals predicted female students' GPA. Peers' academic performance-approach, social mastery, and social performance-avoidance positively predicted GPA while peers' academic performance-avoidance and social performance-approach positively predicted GPA. The male model was significant, $F(6,322) = 6.28$, $p < .001$, $R^2 = .11$. Peers' academic performance-approach goals and peers' social mastery goals positively predicted male students' GPA while peers' academic performance-avoidance goals negatively predicted students' GPA. Males were different from females in that their peers' social performance goals did not matter for their GPA and their peers' goals explained slightly less variance in their GPA (11% compared to 15%).

In order to compare students' race, I ran three consecutive models selecting Asian, Black, and White students, the three largest racial groups in the sample. The three models are shown in Table 6.6. Due to the small sample sizes in the Asian and Black student groups I also noted which variables were marginally significant predictors. The Asian student model was not significant, $F(6,79) = 1.63$, $p = .15$, $R^2 = .11$. Despite the overall model not being significant, there were several significant predictors. Peers' academic performance-approach goals negatively predicted Asian students' GPA, while peers' academic performance-avoidance goals positively predicted Asian students' GPA. Peers' social performance-approach goals marginally negatively predicted students' GPA. The Black student model was significant, $F(6,79) = 2.52$, $p < .05$, $R^2 = .16$. Interestingly, peers' academic performance-avoidance goals negatively predicted Black

students' GPA and peers' social mastery goals positively predicted GPA. This was in large contrast to the Asian student model, suggesting that peers' academic performance-avoidance goals differently impact students' academic achievement across racial groups. The White student model was significant, $F(6,457) = 6.56$, $p < .001$, $R^2 = .08$. The coefficients for the White sample were not as high as for the Asian and Black samples, but because of sample size they were highly significant. Peers' academic performance-approach goals and peers' social mastery goals positively predicted students' GPA while peers' academic performance-avoidance goals negatively predicted students' GPA. There were several interest patterns within the set of analyses. For one, Black and White students were similar in the direction of influence of their peers' goals on their own GPA, while Asian students often followed opposite patterns. It is also noteworthy that Black students' peers' academic and social goals had the most explanatory power (16% of variance in students' GPA) while White students' peers' had smaller explanatory power (8% of the variance in students' GPA).

Conclusion

In summary, change in students' motivation and GPA was predicted by the levels of motivation and GPA of the peers they regularly hang out with at school. Regarding academic goals, only change in students' mastery goals were impacted by their peers. Regarding social goals, changes in students' social mastery goals were impacted by their peers, while changes in social performance-approach goals and -avoidance goals were predicted only by their outgoing peers. Finally, change in students' academic achievement was predicted by their peers' GPA, and by their incoming peers' academic and social goals. Interestingly, peers' academic performance-approach goals were positive predictors

of students' GPA while peers' social performance-approach goals were negative predictors. There were also several important demographic differences—11th graders' GPA is less influenced by peer goals than for 9th and 10th graders, females' GPA was impacted by peers' social performance goals while males' GPA was not, and for only Asian students, peers' academic performance-approach goals were negative and their peers' academic performance-avoidance goals were positive for their GPA. It is important to note that in the demographic models I did not control for prior GPA. Therefore, part of the reason that students' peer levels of motivation and GPA might be predictive of their own is because of peer selection, which was discussed in Chapter 2. What is particular interesting in the non-demographic models that controlled for change (i.e., controlling for students' own previous motivation and GPA), I found that peers levels mattered, giving support for peer socialization effects.

Table 6.1 Predicting Students' Academic Goals With Peers' Academic Goals

Predicting W3 Academic Mastery Goals			
Incoming Peer Levels	β	Outgoing Peer Levels	β
W1 Academic Mastery	.41***	W1 Academic Mastery	.44***
W1 Peers' Academic Mastery	.09*	W1 Peers' Academic Mastery	.09*
W1 Peers' Academic Perf-App	.08	W1 Peers' Academic Perf-App	.06
W1 Peers' Academic Perf-Avoid	-.09	W1 Peers' Academic Perf-Avoid	-.06
Predicting W3 Academic Performance-Approach Goals			
Incoming Peer Levels	β	Outgoing Peer Levels	β
W1 Academic Performance-App	.52***	W1 Academic Performance-App	.53***
W1 Peers' Academic Mastery	.07	W1 Peers' Academic Mastery	.01
W1 Peers' Academic Perf-App	.02	W1 Peers' Academic Perf-App	-.03
W1 Peers' Academic Perf-Avoid	.03	W1 Peers' Academic Perf-Avoid	.04
Predicting W3 Academic Performance-Avoidance Goals			
Incoming Peer Levels	β	Outgoing Peer Levels	β
W1 Academic Performance-Avoid	.45***	W1 Academic Performance-Avoid	.45***
W1 Peers' Academic Mastery	.06	W1 Peers' Academic Mastery	-.02
W1 Peers' Academic Perf-App	-.06	W1 Peers' Academic Perf-App	-.04
W1 Peers' Academic Perf-Avoid	.09	W1 Peers' Academic Perf-Avoid	.09

Note. ^ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Table 6.2 Predicting Students' Social Goals With Peers' Social Goals

Predicting W3 Social Mastery Goals			
Incoming Peer Levels	β	Outgoing Peer Levels	β
W1 Social Mastery	.43***	W1 Social Mastery	.48***
W1 Peers' Social Mastery	.17***	W1 Peers' Social Mastery	.12**
W1 Peers' Social Perf-App	-.04	W1 Peers' Social Perf-App	-.06
W1 Peers' Social Perf-Avoid	-.03	W1 Peers' Social Perf-Avoid	.02
Predicting W3 Social Performance-Approach Goals			
Incoming Peer Levels	β	Outgoing Peer Levels	β
W1 Social Performance-App	.46***	W1 Social Performance-App	.45***
W1 Peers' Social Mastery	-.02	W1 Peers' Social Mastery	-.02
W1 Peers' Social Perf-App	.04	W1 Peers' Social Perf-App	.10*
W1 Peers' Social Perf-Avoid	-.03	W1 Peers' Social Perf-Avoid	-.04
Predicting W3 Social Performance-Avoidance Goals			
Incoming Peer Levels	β	Outgoing Peer Levels	β
W1 Social Performance-Avoid	.40***	W1 Social Performance-Avoid	.40***
W1 Peers' Social Mastery	.00	W1 Peers' Social Mastery	.02
W1 Peers' Social Perf-App	-.03	W1 Peers' Social Perf-App	-.03
W1 Peers' Social Perf-Avoid	.05	W1 Peers' Social Perf-Avoid	.10*

Note. ^ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Table 6.3 Predicting Students' Academic Achievement With Peers' Goals

Predicting W3 Academic Achievement (GPA) with W1 Variables			
Incoming Peer Levels	β	Outgoing Peer Levels	β
W1 Peers' Academic Mastery	-.02	W1 Peers' Academic Mastery	.03
W1 Peers' Academic Perf-App	.28***	W1 Peers' Academic Perf-App	.28***
W1 Peers' Academic Perf-Avoid	-.12*	W1 Peers' Academic Perf-Avoid	-.23***
W1 Peers' Social Mastery	.25***	W1 Peers' Social Mastery	.22***
W1 Peers' Social Perf-App	.01	W1 Peers' Social Perf-App	-.10*
W1 Peers' Social Perf-Avoid	.02	W1 Peers' Social Perf-Avoid	.11*
Predicting W3 Academic Achievement (GPA) with W3 Variables			
Incoming Peer Levels	β	Outgoing Peer Levels	β
W3 Peers' Academic Mastery	.00	W3 Peers' Academic Mastery	.01
W3 Peers' Academic Perf-App	.29***	W3 Peers' Academic Perf-App	.34***
W3 Peers' Academic Perf-Avoid	-.29***	W3 Peers' Academic Perf-Avoid	-.32***
W3 Peers' Social Mastery	.23***	W3 Peers' Social Mastery	.21***
W3 Peers' Social Perf-App	-.12**	W3 Peers' Social Perf-App	-.18***
W3 Peers' Social Perf-Avoid	.13**	W3 Peers' Social Perf-Avoid	.13*
Predicting Change in W3 Academic Achievement (GPA) with W1 Variables			
Incoming Peer Levels	β	Outgoing Peer Levels	β
W1 GPA	.77***	W1 GPA	.81***
W1 Peers' Academic Mastery	-.01	W1 Peers' Academic Mastery	.02
W1 Peers' Academic Perf-App	.12***	W1 Peers' Academic Perf-App	.06
W1 Peers' Academic Perf-Avoid	-.01	W1 Peers' Academic Perf-Avoid	-.04
W1 Peers' Social Mastery	.07**	W1 Peers' Social Mastery	-.01
W1 Peers' Social Perf-App	.03	W1 Peers' Social Perf-App	.01
W1 Peers' Social Perf-Avoid	-.06*	W1 Peers' Social Perf-Avoid	-.01

Note. ^ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Table 6.4 Grade Level Comparison of Predicting Students' Academic Achievement (GPA) with Peers' Goals

DV= W3 GPA	9th graders	10th graders	11th graders
	R^2 = .19	R^2 = .21	R^2 = .09
Incoming Peer Levels	β	β	β
W3 Peers' Academic Mastery	.02	-.04	.01
W3 Peers' Academic Perf-App	.36***	.25**	.16
W3 Peers' Academic Perf-Avoid	-.31***	-.38***	-.18*
W3 Peers' Social Mastery	.27***	.33***	.09
W3 Peers' Social Perf-App	-.03	-.11	-.29**
W3 Peers' Social Perf-Avoid	-.07	.23**	.29**

Note. ^ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Table 6.5 Gender Comparison of Predicting Students' Academic Achievement (GPA) with Peers' Goals

DV= W3 GPA	Female	Male
	$R^2 = .15$	$R^2 = .11$
Incoming Peer Levels	β	β
W3 Peers' Academic Mastery	-.03	.03
W3 Peers' Academic Perf-App	.34***	.27***
W3 Peers' Academic Perf-Avoid	-.35***	-.24**
W3 Peers' Social Mastery	.23***	.20**
W3 Peers' Social Perf-App	-.22***	.00
W3 Peers' Social Perf-Avoid	.20**	.05

Note. ^ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Table 6.6 Race Comparison of Predicting Students' Academic Achievement (GPA) with Peers' Goals

	Asian	Black	White
	$R^2 = .11$	$R^2 = .16$	$R^2 = .08$
Incoming Peer Levels	β	β	β
W3 Peers' Academic Mastery	.05	-.14	-.01
W3 Peers' Academic Perf-App	-.28*	.20	.27***
W3 Peers' Academic Perf-Avoid	.36*	-.36^	-.25***
W3 Peers' Social Mastery	.04	.31*	.18***
W3 Peers' Social Perf-App	-.25^	-.21	-.08
W3 Peers' Social Perf-Avoid	.01	-.02	.09

Note. ^ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

CHAPTER 7

DISCUSSION

Introduction

The research conducted here was designed to examine how high school students' peer relationships interact with their academic motivation, social motivation, and academic achievement. Students' motivation was framed in terms of Achievement Goal Theory and their peer relationships were measured using social network analysis. The study was organized according to three overarching research objectives: 1) to describe the dynamic nature of the high school peer social network and students' academic and social motivation, 2) to understand the relationships and predictive influence among students' academic goals, social goals, peer network position, and academic achievement across the school year, and 3) to examine the impact of peers' academic goals, social goals, and academic achievement on students' own goals and achievement. Evidence was found that peer relationships impact students' motivation and achievement both directly and indirectly (Wentzel & Caldwell, 1997; Martin & Dowson, 2009). Reciprocally, motivation and achievement also impact peer relationships, in that social goals and academic achievement predict students' position among their peers. A summary of the research questions and findings are provided in Table 7.1.

The literature review included a framework (see Figure 2.3) that summarized three levels of research that could be conducted using social network analysis in order to study peer relationships and academic outcomes: individual-individual, individual-

network, and network-network. This framework was established in order to provide structure to the numerous research questions and subsequent analyses that can be used to examine peer relationships and students' academic and motivational development. The three research objectives were conducted at each of these three social network levels, which are used to organize the discussion that follows. Each section includes an interpretation of the significance of the findings in light of the hypotheses and past research. The dissertation is then discussed as a whole in terms of its significance, limitations, and future work.

Summary and Interpretation

Network-Network Level

The network-network level of SNA research (see Figure 2.3) addressed in Chapter 4 provided a descriptive analyses of the entire high school peer social network and how it evolved over time, including such characteristics as levels of heterogeneity within the network. See Table 7.1 for a summary of the results. It was hypothesized that academic and social goals would generally decrease across the school year (e.g., Tuominen-Soini, Salmela-Aro, & Niemivirta, 2011) while the measures of social network position (e.g., indegree, betweenness) would increase on average. These hypotheses were generally supported. Academic and social goals decreased, with the exception of social mastery goals, which remained stable on average. Students' indegree, outdegree, and betweenness increased and then decreased across the school year. It may be that students have fewer friends at the beginning of the year, make the most friends as the year goes on as they are entrenched in classes and extracurricular activities, and then by the end of the year have settled into more established peer groups.

Regarding individual differences, it was expected that males would have higher academic performance goals and that females would have higher centrality. In support of those predictions, females had higher academic and social mastery goals, social network measures, and GPA, while males had higher social performance goals. This is consistent with a recent study, albeit among 7th grade students, which found that females had higher math grades, higher mastery goals, and higher perceptions of peer support than males, while males had higher performance-avoidance goals (Gherasim, Butnaru, & Mairean, 2013). Regarding racial differences, it was expected that broad cultural differences might impact students' goals. Asian students' responses were aligned with Eastern vs. Western differences (Oyserman et al., 2002). It was also expected that there would be differences in indegree and outdegree given previous evidence that Black students listed more friends on average than did White students (Hallinan & Teixiera, 1987). However, the number of peer nominations received and listed (i.e., both indegree and outdegree) for Black students was actually lower than for White and Asian students. It may be that that because Black students are the minority within this school (approximately 13% of the sample), these students are at a disadvantage regarding access to friends. Although there were no specific predictions about grade level differences, the study demonstrated that there were grade level differences within social goals and social network variables (see Table 4.3), but no grade level differences in academic goals or GPA; thus as students become older in the school their social lives may change more than their academic lives.

These results contributed to the literature in several ways. First is that the study examined an entire social network of a high school. Second, the data were obtained more than once, which permitted a degree of causal inference and the opportunity to detect

nonlinear changes over the school year. Third, individual differences in gender, grade level, and race were examined. For example, it was interesting that social mastery goals appeared to remain stable across the year, but after examining individual differences it was determined that students of different grades and genders differed in their trajectories of how social mastery goal changed across the school year. Fourth, uncovering differences in network position are important as these findings contribute to existing literature to provide a more accurate description of how gender, race, and age matter for differences in peer relationships. For example, part of the description included a comparison of heterogeneity scores (Table 4.2). Although it is known that peer groups within schools tend to be similar across age, race, and gender (e.g., Ennet & Bauman, 1996; Hallinan & Teixiera, 1987; Shrum, Cheek, & Hunter, 1988), the present study contributed by showing that high school peers who regularly hang out with one another are most likely to be similar in terms of age first, then gender, and finally race.

Individual-Network Level

The SEM models in Chapter 5 were purposefully designed to examine both antecedents and consequences of social networks, as described in the individual-network level in Figure 2.3. The models examined the hypotheses that students' academic goals, social goals, and GPA would influence their position in the network, and in turn that students' position in the network would influence their academic goals, social goals, and GPA. The study provided evidence that academic and social variables served as both predictors and outcomes in the cross-lagged model, supporting the notion that these processes and outcomes are reciprocally influential. See Table 7.1 for a summary of the research questions and results.

The cross-lagged models provided evidence that: 1) students' academic goals predicted change in their social goals and weakly predicted academic achievement, but did not predict change in their social network position, 2) students' social goals predicted change in their academic goals, social network position, and their academic achievement, 3) students' social network position predicted changes in their social goals and academic achievement, but not in their academic goals, and 4) academic achievement was one of the strongest predictors, predicting change in students' academic goals, social goals, and social network position. Several general conclusions could be drawn from this set of analyses.

First, social mastery goals were important for a range of positive outcomes. While it was expected that social performance-approach goals would more strongly and positively predict social network position than would social mastery goals, in fact the results suggest that they both matter. Students with higher social mastery goals at the beginning of the year ended received more nominations from peers and became more centrally located within the high school network by the end of the year. This mirrors past research demonstrating that social mastery goals are associated with positive social relations and belonginess (Ryan & Shim, 2006; 2008; Mouratidis & Sideridis, 2009), although is in contrast to Horst et al. (2007) who found that positive relations with others was negatively correlated with social performance-approach goals. These findings may explain why social mastery goals led to nominations received (i.e., indegree), social performance-approach goals led to nominations given (i.e., outdegree), and both led to greater betweenness within the network. Contrary to expectation, social performance-avoidance goals were not negatively related to changes in students' social status,

although they were correlated at one point in time. Finally, social mastery goals (but not social performance goals) were positively and reciprocally related to changes in GPA across the school year. This may be in line with Poortvilet and Darnon's (2010) discussion of the positive social benefits of mastery goals and the maladaptive social consequences of performance goals.

A second theme was the lack of findings for academic goals as predictors. Academic performance-approach goals positively predicted change in GPA, although not as predicted, mastery goals did not predict change in GPA over time. Many of the meta-analyses on achievement goals link both academic mastery and performance-approach goals positively to GPA (e.g., Hulleman et al., 2010). I found similar patterns in the covariances at one point in time, i.e., academic mastery goals and performance-approach goals were positively related to GPA at each wave, but this was not supported in the cross lags. Furthermore, academic goals did not have any relationship with the social network variables (e.g., indegree, outdegree, betweenness) when examining these associations across time, despite being correlated at one point in time. It may be that the relationship between academic goals and social network position is indirect, or that there was not enough time between the waves to understand the impact of academic goals on peer relations. Academic mastery goals did, however, predict positive changes in social mastery goals, suggesting that some of the benefits from academic mastery goals may be mediated by social mastery goals. This may explain why academic mastery did not predict change in GPA, since past GPA and social mastery goals were also controlled for at the same time. Researchers also argue that students' academic mastery goals, i.e. goals

to understand the material and improve upon one's past understanding, are important outcomes in their own right (Ames, 1990).

The third theme is that GPA was a strong predictor. This was unexpected. Students with higher academic achievement increased in their academic mastery goals, academic performance-approach goals, social mastery goals, and social performance-avoidance goals, while decreasing in social performance-approach goals (see Figures 5.2 to 5.7). These findings reflect an important cycle—it is easier for students to be motivated and to enjoy school and want to have good quality relationships when they are also achieving well. Students with higher academic achievement also increased in the number of peers they listed, in the number of peers who nominated them, and in their betweenness in the peer social network of the high school. Unclear is why they would also increase in the level of social performance-avoidance goals if they are becoming more popular, although it should be noted they also increased in social mastery. It may be that these high achievers who have become popular become more concerned about losing their newfound status. At least at this high school it can be concluded that students with higher GPA generally develop more adaptive motivations and become better connected with their peers.

A final theme was the differences uncovered between indegree (the number of nominations received by a student from his or her peers) and outdegree (the number of peer nominations given by a student). Within the correlations at one point in time, indegree was related more strongly positively related to GPA than outdegree. Within the cross-lagged models, indegree predicted positive change in social mastery goals and negative change in social performance-avoidance goals, as well as change in outdegree,

whereas outdegree did not predict change in any variables except for indegree. As antecedents, indegree was predicted by social mastery goals, while outdegree was predicted by social performance-approach goals. These combined results suggest that despite sharing some variance, indegree and outdegree are unique variables that predict and are predicted by different motivations and achievement. Given that outdegree is more controlled by the student, since it is a self-reported measure of the students' perceptions of whom they regularly hang out with, it is not surprising that wanting to appear popular (i.e., social performance-approach) would predict an increase in how many peers students list on the survey. The model specifically controlled for indegree at the same time, thus these results reflect an increase in how many peers were stated by the student, controlling for how many they were actually hanging out with as reported by their peers. Furthermore, since indegree relates more strongly to GPA than outdegree, which is attributed to the theory of peer social capital and the benefits and resources students receive from being well connected within a social network, it may be a more objective representation of students' actual peer interactions and access to peers than outdegree.

In sum, these results provide further evidence that students' interpersonal goals may be just as important or even more important than their academic goals while at school (Covington, 2000). This set of analyses in particular contributed to the literature because of the collection of three waves of longitudinal data and use of cross-lagged models. Many studies examining how network variables, such as popularity, impact students' academic achievement do not control for past achievement. Furthermore, this set of analyses as compared to research focusing on peer socialization was meaningful because all students could be included, not just students who had peer connections or

who did not fit neatly into one particular peer group. Finally, uncovering these associations among the variables across time was especially significant given the high stability of the variables across the year and controlling for the covariance among variables at each point in time.

Individual-Individual Level

The individual-individual level examined in Chapter 6 focused only on peers' direct connections. A summary of the results is provided in Table 7.1. The analyses found that changes in students' academic goals, social goals, and academic achievement could be predicted by the levels of motivation and achievement of the peers with whom they regularly hang out with at school. In other words, a proportion of students' own motivation and academic achievement was socialized by their peers. This is line with myriad research showing that student' behaviors and motivations are influenced by their friends (e.g., Christakis & Fowler, 2009, Kindermann, 2007; Ryan, 2001). Interestingly, when it came to academic goals, only academic mastery goals showed the effects of socialization. This is counterintuitive, since peers with academic performance goals should be focused on social comparison and make outward displays of competition and comparison with the student, and thus students connected to peers with high average levels of academic performance goals should have been more strongly socialized. It may be that peers' academic performance goals were not high enough on average to be influential, as suggested by their overall lower means compared to mastery goals.

Regarding social goals, the average level of mastery of both incoming and outgoing peer nominations (i.e., those that nominated the student, and those that were nominated *by* the student) predicted changes in students' mastery goals, while only

outgoing peers predicted changes in social performance goals. In this case there was a difference in terms of influence between incoming peer levels and outgoing peer levels. It may be that students nominate peers whom they like the most and want to hang out with, and not always exactly whom they actually spend all their time with. If the peers that students nominate are those they admire and want to be like, then they may become more focused on their outgoing peers' social performance-avoidance goals and over time begin to adopt some of the same behaviors. Perhaps outgoing measures of peers may be more relevant for understanding students' motivations at school. This possible difference is specifically why both indegree and outdegree, and consequently both incoming and outgoing peer measures, were included in the present study. Researchers studying peer socialization should be aware of these differences when deciding whether to measure students' peer relationships as either self-reported or as reported by their peers.

Another pronounced finding within this chapter focused on students' academic achievement. The average GPA and academic and social goals of the peers that students are directly connected to predicted students' own GPA as well as change in students' GPA across the school year. This finding is consistent with current research demonstrating a positive correlation between high school student peers' average GPA and the student's own academic progress (Blansky, Kavanaugh, Boothroyd, Benson, Gallagher, et al., 2013). Interestingly, peers' academic performance-approach goals were positive predictors of students' academic achievement while peers' social performance-approach goals were negative predictors. In other words, students who hung out with peers who wanted to get high grades and outperform others had higher GPA, while students who hung out with peers who wanted to be popular had lower GPA. Thus

performance-approach goals are harmful for academic achievement when within the social realm. Unexpectedly, the academic mastery goals of students' peers had no relation with their GPA. Although it was predicted that peers with academic mastery goals would be more cooperative and help one another and thus lead students to have higher GPA over time, as discussed in Chapter 2, these goals may be experienced more individually, especially if the peers a student hangs out with are not the same ones who they collaborate with within classrooms. It was also noteworthy that when predicting change in students' GPA across the school year (bottom of Table 6.3), incoming peer levels of goals significantly predicted change in students' GPA while outgoing peer levels did not. Thus it may be that students' actual network rather than their desired network (those they nominate) are meaningful for their academic achievement, which is contrast to predicting social-performance goals.

There were also several important demographic differences. 11th grade peers' goals matter less for their GPA than they do for 9th and 10th graders (Table 6.4), which may be a function of either a growing separation between social and academic realms, or because friendships are more established at this point and thus there is less need to adapt to the behaviors of one's peers in order to fit in. Regarding gender (Table 6.5), females' GPA was impacted by peers' social performance goals while males' GPA was not. This is consistent with research demonstrating that peer relationships may matter more for girls and that they spend more time interacting with friends than do boys (e.g., Blatchford, Baines, & Pellegrini, 2003; Ma & Huebner, 2008). Furthermore, competition among males is more common than among females (e.g., Mathur & Berndt, 2006) and thus it would not be especially impactful if boys' peers were higher in social performance

goals because it would be the norm. Regarding race (see Table 6.6), for Asian students, in contrast to Black and White students, peers' academic performance-approach goals were negatively related to their GPA while peers' academic performance-avoidance goals were positively related to their GPA. This is in line with individualism vs. collectivism theory (Oyserman et al., 2002) and the assumption that Western individualism supports open expression of attainment of one's personal goals, as well as cultural differences as suggested by Dowson and McInerney (2003), who note that Eastern cultures may have academic goals to please teachers or to help one's peers. Thus Asian students' peers' performance-approach goals may be especially negative, while peers' academic performance-avoidance goals (i.e., not wanting to fail, not wanting to get the lowest score) are in line with Eastern cultural norms. As previously discussed, the model chosen for the demographic comparisons did not control for prior GPA, in order to explore whether there were individual differences. Therefore, part of the reason that students' peer levels of motivation and GPA might be predictive of their own is because of peer selection.

As briefly mentioned above, the results uncovered an intriguing difference between the roles of academic vs. social performance goals on students' achievement. When students' peers had goals to demonstrate competence in academics then students tended to have higher academic achievement. However, when peers had goals to demonstrate competence in the social realm then students tended to have lower academic achievement. When students' peers had goals to avoid demonstrating incompetence in academics then students had lower academic achievement, while peers who had goals to avoid demonstrating incompetence in the social realm resulted in students having higher

academic achievement. Thus performance-approach goals and performance-avoidance goals across academic and social domains do not function similarly for academic achievement, despite the similarly between the frameworks. Performance-avoidance goals can be adaptive for academic achievement outcomes, specifically in a social context where perhaps peers are worried about being unpopular and thus may spend more time on schoolwork and focus their efforts on academics. If a student's peers are approaching popularity they may actually discourage that student from spending time on schoolwork or engaging in other academic behaviors that lead to success.

This set of analyses contributes to the field in several ways. While researchers have examined peer socialization of expectations and values (e.g., Ryan, 2001) and engagement (e.g., Kindermann, 2007), I am not aware of any previous research examining how high school students' peers socialize one another specifically in terms of academic and social goals. Furthermore, creating separate variables of both the level of motivation and GPA of peers who nominated the student (incoming peers) and of peers who were nominated by the student (outgoing peers) was also unique. This approach begins to paint a picture of whether actual peer connections matter, perceived peer connections matter, or both, which has broad implications for psychological research on peer relationships. Within this study, outgoing peers and the outdegree network measure are essentially self-report, while incoming peers and the indegree network measure are other-report, since they are generated for an individual based on what others reported. This study included both measures in order to understand whether there were differences between the two. Some outcomes such as students' performance-goals may be adequately assessed by their peer perceptions, especially if the outcome involves students' subjective

beliefs, while other outcomes, such as getting access to important resources within a network, may be better assessed with other-report or a more objective measure. This is in fact what I found: change in performance goals were related more to students' outgoing peer nomination levels while changes in GPA were related more to students' incoming peer levels of motivation and GPA.

Significance and Implications

This dissertation provided a significant contribution by addressing each of the three conceptual problems that were mentioned in the introduction (Chapter 1): direction of influence, combining academic and social processes, and conceptualizing the influence of peer relationships. The specific findings also have important theoretical and practical implications for improving the nature of schools.

One contribution of the study is that it begins to address the question of direction of influence. Whereas research typically focuses on how peers impact students, which is important, it often fails to account for the dynamic nature of peer relationships, including how peer relationships may in turn be impacted by students' own social strivings and academic achievement. Chapter 4 in particular used cross-lagged structural equation modeling to examine causal mechanisms. For example, the fact that students' social mastery goals positively predict students' academic mastery goals, social network position, and GPA suggests that social mastery is a powerful antecedent and thus should be an important component of school intervention programs. In order to promote academic achievement, school interventions should focus on promoting positive peer interactions and reducing peer isolation. Such interventions or programs, often labeled socioemotional learning, should not only teach social skills, but should also add a

component that focuses on promoting students' social mastery goal motivation, i.e., promoting students' motivation to have high quality relationships with their peers.

A second contribution of the study was that it brought together research on academic motivation and academic outcomes with research on social motivation and social outcomes. This dissertation attempted to address this by examining social goals, academic goals, social network position, and academic achievement all within the same sample at each of the waves. One critical finding is that social motivations and peer relationships seemed to matter more heavily for academic achievement than academic motivation. This implies that academically-focused interventions, such as curriculum reform, may be more effective if they include a social component. One type of existing intervention that attempts to do this are small learning communities (also called schools-within-schools) that promote academic reform by banding both students and teachers into smaller teams, which aim to facilitate student motivation and academic achievement (Felner, Seitsinger, Brand, Burns, & Bolton, 2007). Unfortunately, the current educational regime of accountability focuses heavily on student test scores, leaving behind important social skills that students need to be successful, not only academically but also as important outcomes in their own right (Ryan & Brown, 2005; Au, 2007).

A third contribution of the study is that it addressed the need to conceptualize the influence of peer relationships appropriately, which in part relies upon available methods for measuring peer influences. Students' position in the classroom or school network, as well as their direct connections to their peers, may relate to their academic and social motivation as well as their academic achievement. There is a need to understand the various ways in which SNA can be used (discussed at length above) as well as what

information can be garnered from these different approaches. The present study examined the entire social network, students' position in that network, and local direct peer connections and found different information unveiled at each level. With regard to academic achievement, for example, students' centrality in their peer social network and the number of peer connections positively related to their academic achievement. Furthermore, changes in their academic achievement were predicted by their directly connected peers' average level of academic achievement, which suggests socialization effects as well. Thus these various forms of network analyses should be a useful tool for educators and researchers to measure and evaluate whether social interventions such as small learning communities impact peer interactions as they are intended to do so and how social interventions impact the social structure of the school, both at the broad network level and at the more direct local level (e.g., Gest et al., 2011).

Limitations

Despite the wealth of information received from extensively studying students and their peer relationships within one high school, the one school sample limits generalizability. The school has specific demographic features and relatively high achievement on standardized exams, which differ from other schools in the state and in the country. In particular, this is a new school and only had three grade levels; it will be important to determine whether more established schools and schools with all four grade levels have similar results. It is likely that many aspects of this new organization could influence the social structure of students, such as the lack of coherent pre-existing social groups and their existing social norms. Additionally, social norms at the school in terms of teacher relationships and leadership are also in their infancy. This could potentially

positively bias peer relationships and motivation at school, since presumably teacher and student motivation is higher at the beginning of a new organization and then decreases and levels out over time.

Another limitation that exists in all studies that use social network analysis concerns the cognitive validity of items and scales used to operationalize the social network constructs that are assessed (see Karabenick et al., 2007). The network measure used in this study specifically included the words "hang out with" rather than "friend" in order to assess interactions with peers. It is unknown, however, how students interpret the term "hang out"; does this include peers with whom students interact with regularly in person as well online and via mobile phone? A recent Pew study found that U.S. teens exchange text messages more than phone calls, face-to-face socializing outside of school, social network messaging, instant messaging, and emailing (Lenhart, 2012). Does "hang out" mean that students actually interact frequently with all of the peers listed? Due to the nature of how data were collected, students were not able to rate their interactions with each individual listed. Thus all interactions were treated as equal, although in actuality they could vary in terms of how often students hang out with the peers they listed and the quality of those peer interactions. As noted in Chapter 2, defining the relationships and how to collect data is a highly important step in the social network analysis process, and researchers must be aware of the limitations of any particular approach.

The measures used to examine academic and social goals, as well as academic achievement, may also be limited. There is research indicating that student academic motivations vary by academic subject (e.g., Green, Martin, & Marsh, 2007). It is also possible that students' social motivations are context-specific or even relationship-

specific (e.g., Salmivalli & Peets, 2009). However, all of the analyses are at the level of the school, not the classroom; therefore to be consistent the measures included in this dissertation measured academic goals across all subjects and social goals across all social contexts and relationships. A school level analysis of peer relationships allows for more appropriate observations of natural friendships in the high school setting (Kindermann & Gest, 2009). GPA may not completely reflect achievement (and certainly may not reflect actual learning) yet remains important for several reasons. The limitations and advantages of GPA as a measure of academic achievement are discussed previously in the measures section of Chapter 3.

Furthermore, missing data may be an issue. Reasons for missing data included the typical challenges in obtaining active permission from students and their parents, student absenteeism, and carelessness in filling out surveys, all compounded by the three-wave research design. As stated in Chapter 3, various types of missing data can lead to inaccurate estimates of network-level statistics (e.g., Kossinets, 2006). Steps were taken to remedy the issue of missing data. The number of peers that can be listed in the current study was relatively high across typical social network analysis procedures, which meant that even if a student was not included in the sample he or she would likely to be nominated by others, which essentially builds the full network structure more accurately. Furthermore, parent permission was collected in person during registration dates at the school, through two home mailings, and by attending a PTO meeting in order to increase parent permission and thus participation rates. Although it cannot be tested, it is likely that students who may have the most social and/or academic problems at school would be less likely to agree to participate or to receive parent permission to participate, thus the

results may reflect a sample that is biased to have more adaptive social and academic processes. In any case additional replication studies with less missing data are recommended.

Future Work

Despite the wealth of information derived from extensively studying the students within one high school, the study should be expanded to additional schools for several reasons. The first would be to determine whether these findings are normative phenomena or a feature of particular school climates. In schools where academic achievement is not valued, it may be expected that students with social performance goals should have lower GPA since they are concerned about being well connected within a school where academic achievement is not congruent with popularity. In schools where academic achievement is valued or esteemed, the opposite would be expected—students with performance social goals may strive to look smart in order to be popular. Second, comparison across schools would enable network-network level research in order to determine important school-level differences in how peer networks operate. For example, how may the average indegree of students or the structure of peer relationships differ between a larger vs. a small high school? Third, conducting the study in multiple schools would benefit from looking at schools with different demographic proportions (e.g., schools with greater racial diversity, or all-female schools) to determine whether the processes replicate in these contexts. Finally, comparing across schools could be beneficial if different school levels are compared, for example, how networks at the high school level compare to school-wide networks within middle schools, or within colleges.

Future studies on peer social networks and students' academic development should continue to examine individual differences such as gender, race, and grade level as moderators, as well as expand to include additional moderators. This may include examining socioeconomic status, which was not available in this study. A second option would be treating academic achievement as a moderator for students. Students' academic achievement level may moderate the influences between students' network position and their motivation, or the influences of peers' level of motivation on students' own motivation. For example, I predict that students with low GPA may be more strongly influenced by peer academic performance goals than students with high GPA. In Chapter 5, six complex models were conducted that examined the influences among goals, network position, and GPA. Although it would exponentially increase the number of models, it would be interesting to determine whether there are group level differences (e.g., gender, race, grade level, SES, achievement level, etc.) in the relationships between these variables. Finally, an additional moderator that would be relevant to include is students' perception of peer support. Some well-connected students may not feel peer support, and some students with only one friend may feel a lot of peer support. Examining the interaction of subjective, internal feelings of peer support with more external measures of social network connections could produce some exciting findings.

The study of peer social networks could also be expanded to include other types of peer networks. Students have networks of peers whom they hang out with socially, networks of peers to whom they go for academic support or other forms of academic interactions, and networks of peers that exist within classrooms. These networks may certainly overlap in some ways but may also differ in very important ways. Academic

goals were not highly related to network position over time in this study, but these goals may play a much stronger role by directly examining academic peer networks (i.e., "Who do you interact with the most about your schoolwork?") rather than general social peer networks (i.e., "Who do you hang out with the most?"). Social network analysis also has significant implications for help-seeking research since help seeking is a strategy that is particularly affected by the social context (e.g., Karabenick & Knapp, 1991; Rousell, Elliot, & Feltman, 2010). As suggested by Makara and Karabenick (in press), researchers could examine academic help seeking peer networks (i.e., "Who do you go to when you need help on your schoolwork?"). Using such data, researchers could examine patterns of help seeking within schools or other learning environments, whether and when help seeking is reciprocated, and whether help seeking is occurring broadly across the course or only within certain pockets of students.

Finally, there is a need to include the very important role of teachers within social network research within schools. Particular teacher practices may promote peer-peer relationships in schools (see research on collaborative learning, e.g., Volet, Summers, & Thurman, 2009). If the teacher interacts heavily with each student, students may be less likely to rely on each other for support, or the opposite, teachers who model appropriate interaction behavior may increase peer-peer interaction. Researchers should also examine student-teacher networks within schools. Understanding teacher-student relationships in addition to peer-peer relationships has pedagogical implications. For example, research on perceptions of social support suggest that high school students who perceive high levels of support from friends, teachers, and parents, as opposed to just one or two of the sources, have the best educational motivation, behaviors, and outcomes (Rosenfeld,

Richman, & Bowen, 2000). Although some researchers have studied school-wide peer-peer interactions (e.g., Blansky et al., 2013) and school-wide teacher-teacher interactions (e.g., Hawe & Ghali, 2008), no research has examined teacher-teacher, teacher-student, and student-student interactions simultaneously in order to understand the entire realm of social interactions that exist within a school, which would be a great contribution.

Conclusion

This study contributes to growing evidence that peer relationships are an important component of the school context, that adolescent peer relationships are not maladaptive for students' education success but rather can be promotive for both their motivation and academic achievement, and that academic and social components of schools are reciprocally intertwined. Social network analysis was used in three different ways to examine the relationships between peer relationships and students' motivation and academic achievement. Peers matter in direct ways, as evidenced through local measures of network position as well as from an examination of the average level of peers' goals and achievement on students' goals and achievement. They also matter in indirect ways; peer connections form a larger social network of the school that has its own characteristics and that provide opportunities for some students to be more central than other students. As a consequence of these multiple perspectives and the inclusion of both social and academic motivations, the present study provided a comprehensive demonstration of the importance of peers for students' academic development. In sum, learning at school is a social endeavor. It is strongly suggested that current educational policies move toward a focus on practices that encourage positive academic and social goals and that promote positive peer relationships within schools.

Chapter 7 References

Ames, C. (1990). Motivation: What teachers need to know. *Teachers College Record*, *91*(3), 409–421.

Au, W. (2007). High-stakes testing and curricular control: A qualitative metasynthesis. *Educational Researcher, 36,* 258-267. doi: 10.3102/0013189X07306523

Blansky D, Kavanaugh C, Boothroyd C, Benson B, Gallagher J, et al. (2013) Spread of Academic Success in a High School Social Network. PLoS ONE 8(2): e55944. doi:10.1371/journal.pone.0055944

Blatchford, P., Baines, E., & Pellegrini, A. (2003). The social context of school playground games: Sex and ethnic differences, and changes over time after entry to junior school. *British Journal of Developmental Psychology, 21*(4), 481–505. doi: 10.1348/026151003322535183

Christakis, N. A., & Fowler, J. H. (2009). *Connected: The surprising power of our social networks and how they shape our lives.* New York, NY: Little, Brown and Company.

Covington, M. V. (2000). Goal theory, motivation, and school achievement: An integrative review. *Annual Review of Psychology*, *51*, 171–200. doi: 10.1146/annurev.psych.51.1.171

Dowson, M., & McInerney, D. M. (2003). What do students say about their motivational goals?: Towards a more complex and dynamic perspective on student motivation. *Contemporary Educational Psychology*, *28*(1), 91–113. doi:10.1016/S0361-476X(02)00010-3

Ennett, S. T., & Bauman, K. E. (1996). Adolescent social networks: School, demographic, and longitudinal considerations. *Journal of Adolescent Research, 11*(2), 194–215. doi: 10.1177/0743554896112003

Felner, R. D., Seitsinger, A. M., Brand, S., Burns, A., & Bolton, N. (2007). Creating small learning communities: Lessons from the project on high-performing learning communities about 'what works' in creating productive, developmentally enhancing, learning contexts. *Educational Psychologist, 42*, 209-221.

Gest, S. D., Osgood, D. W., Feinberg, M. E., Bierman, K. L., & Moody, J. (2011). Strengthening prevention program theories and evaluations: Contributions from social network analysis. *Prevention Science, 12*(4), 349–360. doi: 10.1007/s11121-011-0229-2

Gherasim, T., Harzallah, M., Berio, G., & Kuntz, P. (2013). Methods and tools for automatic construction of ontologies from textual resources: A framework for

comparison and its application. *Advances in Discovery and Management: Studies in Computational Intelligence, 471*(2013), 177–201. doi: 10.1007/978-3-642-35855-5_9

Green, J., Martin, A. J., & Marsh, H. (2007). Motivation and engagement in English, mathematics and science high school subjects: Towards an understanding of multidimension domain specificity. *Learning and Individual Differences, 17*(3), 269–279. doi: 10.1016/j.lindif.2006.12.003

Hallinan, M. T., & Teixeira, R. A. (1987). Students' interracial friendships: Individual characteristics, structural effects, and racial differences. *American Journal of Education*, *95*(4), 563–583. doi: 10.1086/444326

Hawe, P., & Ghali, L. (2008). Use of social network analysis to map the social relationships of staff and teachers at school. *Health Education Research, 23*(1), 62–69. doi: 10.1093/her/cyl162

Horst, J. S., Finney, S. J., & Barron, K. E. (2007). Moving beyond academic achievement goal measures: A study of social achievement goals. *Contemporary Educational Psychology*, *32*(4), 667–698. doi: 10.1016/j.cedpsych.2006.10.011

Hulleman, C. S., Schrager, S. M., Bodmann, S. M., & Harackiewicz, J. M. (2010). A meta-analytic review of achievement goal measures: Different labels for the same constructs or different constructs with similar labels? *Psychological Bulletin, 136*(3), 422–449. doi: 10.1037/a0018947

Karabenick, S. A., & Knapp, J. R. (1991). Relationship of academic help seeking to the use of learning strategies and other instrumental achievement behavior in college students. *Journal of Educational Psychology*, *83*(2), 221–230. doi:10.1037/0022-0663.83.2.221

Karabenick, S. A., Woolley, M. E., Freidel, J. M., Ammon, B. V., Blazevski, J., Bonney, C. R., De Groot, E., Gilbert, M. C., Musu, L., Kempler, T. M., & Kelly, K. L. (2007). Cognitive processing of self-report items in educational research: Do they think what we mean? *Educational Psychologist*, *42*(3), 139–151. doi: 10.1080/00461520701416231

Kindermann, T. A. (2007). Effects of naturally existing peer groups on changes in academic engagement in a cohort of sixth graders. *Child Development*, *78*(4), 1186–1203. doi: 10.1111/j.1467-8624.2007.01060.x

Kindermann, T. A., & Gest, S. D. (2009). Assessment of the peer group identifying naturally occurring social networks and capturing their effects. In Rubin, K. H., Bukowski, W., & Laursen, B. [Eds.], *Handbook of peer interactions, relationships and groups* (pp. 100–117). New York, NY: Guilford Press.

Kossinets, G. (2006). Effects of missing data in social networks. *Social Networks, 28*(3), 247–268. doi: 10.1016/j.socnet.2005.07.002

Lenhart, A. (2012). Teens, Smartphones & Texting. Pew Research Center's Internet & American Life Project. Retrieved on Nov 28, 2012 from http://pewinternet.org/Reports/2012/Teens-and-smartphones.aspx

Ma, C. Q., & Huebner, E. S. (2008). Attachment relationships and adolescents' life satisfaction: Some relationships matter more to girls than boys. *Psychology in the Schools*, *45*(2), 177–190. doi:10.1002/pits.20288

Makara, K. A., & Karabenick, S. A. (in press). Characterizing sources of academic help in the age of expanding educational technology: A new conceptual framework. In S. A. Karabenick & M. Puustinen (Eds.). *Advances in help-seeking research and applications: The role of emerging technologies*. Charlotte, NC: Information Age Publishing.

Martin, A. J., & Dowson, M. (2009). Interpersonal relationships, motivation, engagement, and achievement: Yields for theory, current issues, and educational practice. *Review of Educational Research*, *79*(1), 327–365. doi:10.3102/0034654308325583

Mouratidis, A. A., & Sideridis, G. D. (2009). On social achievement goals: Their relations with peer acceptance, classroom belongingness, and perceptions of loneliness. *The Journal of Experimental Education*, *77*(3), 285–308. doi: 10.3200/JEXE.77.3.285-308

Oyserman, D., Coon, H. M., & Kemmelmeier, M. (2002). Rethinking individualism and collectivism: Evaluation of theoretical assumptions and meta-analyses. *Psychological Bulletin*, *128*(1), 3–72. doi:10.1037/0033-2909.128.1.3

Poortvliet, P. M., & Darnon, C. (2010). Toward a more social understanding of achievement goals: The interpersonal effects of mastery and performance goals. *Current Directions in Psychological Science, 19*(5), 324–328. doi: 10.1177/0963721410383246

Rosenfeld, L. B., Richman, J. M., & Bowen, G. L. (2000). Social support networks and school outcomes: The centrality of the teacher. *Child and Adolescent Social Work Journal, 17*(3), 205–226. doi: 10.1023/A:1007535930286

Roussel, P., Elliot, A. J., & Feltman, R. (2010). The influence of achievement goals and social goals on help-seeking from peers in an academic context. *Learning and Instruction, 21*(3), 394–402. doi:10.1016/j.learninstruc.2010.05.003

Ryan, A. M. (2001). The peer group as a context for the development of young adolescent motivation and achievement. *Child Development*, *72*(4), 1135–1150.

Ryan, R. M., & Brown, K. W. (2005). Legislating competence: High-stakes testing policies and their relations with psychology theories and research. In Elliot, A. J., & Dweck, C. S. [Eds.], *Handbook of competence and motivation* (pp. 354-374). New York: Guildford Publications.

Ryan, A. M., & Shim, S. S. (2006). Social achievement goals: The nature and consequences of different orientations toward social competence. *Personality and Social Psychology Bulletin*, *32*(9), 1246–1263. doi: 10.1177/0146167206289345

Ryan, A. M., & Shim, S. S. (2008). An exploration of young adolescents' social achievement goals and social adjustment in middle school. *Journal of Educational Psychology*, *100*(3), 672–687. doi: 10.1037/0022-0663.100.3.672

Salmivalli, C., & Peets, K. (2009). Pre-adolescents' peer-relational schemas and social goals across relational contexts. *Social Development, 18*(4), 817–832. doi: 10.1111/j.1467-9507.2008.00515.x

Shrum, W., Cheek, Jr., N. H., & Hunter, S. M. (1988). Friendship in school: Gender and racial homophily. *Sociology of Education, 61*(4), 227–239.

Tuominen-Soini, H., Salmela-Aro, K., & Niemivirta, M. (2011). Stability and change in achievement goal orientations: A person-centered approach. *Contemporary Educational Psychology, 36*(2), 82–100. doi: 10.1016/j.cedpsych.2010.08.002

Wentzel, K. R., & Caldwell, K. (1997). Friendships, peer acceptance, and group membership: Relations to academic achievement in middle school. *Child Development*, *68*(6), 1198–1209. doi:10.2307/1132301

Table 7.1 A Summary of the Research Questions and Findings

Research Objective 1: A Description of the High School Peer Social Network and Motivational Dynamics	
Research Questions	**Findings**
1a. What are the students' reported academic and social goals, social network variables, and GPA at each wave?	• Students rated academic and social mastery goals higher than academic and social performance goals • Outdegree was typically higher than indegree
1b. What does the entire social network of the high school look like at each wave?	• Students are most similar to their connected peers in terms of grade level, then gender, then race
1c. Do students' academic goals, social goals, social network variables, and academic achievement differ based on their gender, race, and grade level?	• Social performance-approach and -avoidance goals, indegree, outdegree, betweenness, and GPA significantly differ by grade level • Females higher on network position, GPA, and academic and social mastery while males were higher on social performance goals • Asian students generally rated higher on academic mastery, Black students were generally lower on network position variables, and all three groups differed in terms of GPA
1d. What are the interrelationships of academic and social goals, social network variables, and GPA both within each wave and across waves?	• Numerous intercorrelations among the variables, both within and across waves • Possibly problematic correlations between academic and social performance-approach and –avoidance goals
1e. How do academic goals, social goals, social network variables, and academic achievement change across the school year, and do these changes across the school year differ by gender, race, and grade level?	• Almost all of the variables—academic performance-approach goals, academic performance-avoidance goals, social mastery goals, social performance-approach goals, social performance-avoidance goals, indegree, outdegree, betweenness, and GPA—significantly changed across the school year, with the exception of social mastery • However, change in social mastery had gender and grade level differences. • Grade level differences were most common across variables, most variables did not change differently across the school year depending upon students' race or gender, despite there being within wave differences • Not all changes in the variables were linear, they were often quadratic, increasing and then decreasing across the year
Research Objective 2: Modeling the Influences of Academic Goals, Social Goals, Peer Network Position, and Academic Achievement	

Research Questions	Findings
2a. How do students' academic and social goals predict changes in each other across the year?	• Academic goals predicted positive change in their similar social goals, but only from the middle to the end of the school year (e.g., students' academic mastery goals positively predicted their end of year social mastery goals), while controlling for past levels of the variables and allowing the variables to covary at each time point • Social goals positively predicted change in academic goals, mostly in the second half of the year as well.
2b. How do the social network variables and students' academic and social goals predict changes in each other across the year?	• Students' academic goals did not predict their social network position over time, and in turn, social network variables did not predict changes in students' academic goals • Students with social mastery goals increased in their betweenness in the first half of the year, and increased in the number of peer nominations they received in the second half of the year; social performance-approach goals were also beneficial for students' betweenness as well as how many peers they named; social performance-avoidance goals had no impact on network position. • Students' indegree and betweenness in the social network positively influenced their social mastery goals, while outdegree did not predict any social goals; indegree led to a decrease in their social performance-avoidance goals in the first half of the year
2c. How do students' academic goals, social goals, network position, and GPA predict changes in each other across the school year?	• GPA had high stability across the school year • Students' academic performance-approach goals positively influenced GPA, while academic mastery and performance-avoidance did not • Students' social mastery goals positively predicted end of the year GPA, while performance-approach and –avoidance did not • Students' betweenness positively predicted an increase in their GPA while students' indegree and outdegree did not • In turn, GPA predicted an increase in students' academic mastery and academic performance-approach goals in the first half of the year, as well as an increase in their social mastery goals across the year, social performance-avoidance goals in the second half of the year, and a decrease in social performance-approach goals • GPA positively predicted change in the number of peers students listed, the number of peers who nominated them, and in their betweenness
Research Objective 3: The Impact of Peers' Goals and Achievement on Students' Goals and Achievement	

Research Questions	Findings
3a. How do peers' academic goals predict changes in students' academic goals?	• Students' end of the year academic mastery goals were positively predicted by their peers' academic mastery goals, controlling for students' past mastery
3b. How do peers' social goals predict changes in students' social goals?	• Changes in students' social mastery goals were impacted by their peers, while changes in social performance-approach goals and -avoidance goals were predicted only by their outgoing peers
3c. How do peers' academic and social goals predict changes in students' GPA?	• While peers' social mastery is positively related to students' GPA, peers' mastery in the academic domain did not impact GPA • Peers' academic performance-approach goals were positive predictors of students' GPA while peers' social performance-approach goals were negative predictors • When predicting change in GPA, incoming peer levels of academic and social goals mattered more than outgoing peer levels
3d. How does peers' GPA predict changes in students' GPA?	• Peers' GPA matters for changes in students' GPA, and comparing the standardized coefficients it appears that incoming peers' GPA (the GPA of peers nominate the target student) is a stronger predictor than outgoing peers.
3e. Are there differences in the impact of peers based on students' own grade level, gender, or race?	• 11^{th} graders' GPA less influenced by peer goals than for 9^{th} and 10^{th} graders • Females' GPA was impacted by peers' social performance goals while males' GPA was not • For only Asian students, peers' academic performance-approach goals were negative and their peers' academic performance-avoidance goals were positive for their GPA

APPENDIX A

STUDENT SURVEYS

A.1 Academic Goal Survey

Please indicate the extent to which the following statements describe you.

	Not at all true of me		Somewhat true of me		Very true of me
Learning a lot of new things is important to me.	O	O	O	O	O
Doing better than other students is important to me.	O	O	O	O	O
My goal is to keep others from thinking I'm not smart.	O	O	O	O	O
One of my main goals is to improve my skills.	O	O	O	O	O
My goal is to look smarter than other students.	O	O	O	O	O
It is important to me that I don't look stupid.	O	O	O	O	O
My main goal is to learn as much as I can.	O	O	O	O	O
One of my goals is to show others that school is easy for me.	O	O	O	O	O
An important reason I do my schoolwork is so that I don't embarass myself.	O	O	O	O	O
Really understanding work is important to me.	O	O	O	O	O
It's important to me that others think I'm good at school.	O	O	O	O	O
I do my schoolwork so that my teachers don't think I know less than others.	O	O	O	O	O
Learning new skills is one of my goals.	O	O	O	O	O
My goal is to do better than other students.	O	O	O	O	O
My goal is to avoid looking like I can't do my work.	O	O	O	O	O

Note. Instrument is from the Math Science Partnership – Motivation Assessment Program, which was a revision of the Patterns of Adaptive Learning Scales (Midgley et al., 2000). Items are edited slightly so that they are generalized to the school level.

A.2 Social Goal Survey

Please indicate the extent to which the following statements describe you.

	Not at all true of me		Somewhat true of me		Very true true of me
It is important to me to have friends who really understand me.	O	O	O	O	O
My goal in most social situations is to impress others.	O	O	O	O	O
My goal is to avoid doing things that would cause others to make fun of me.	O	O	O	O	O
It is important to me to have friends who truly care about me.	O	O	O	O	O
It is important to me to be seen as having a lot of friends.	O	O	O	O	O
In social situations I am often concerned about the possibility that others will think I am a loser.	O	O	O	O	O
It is important to me to work on improving the quality of my relationships with my friends.	O	O	O	O	O
I want to be friends with "popular" people.	O	O	O	O	O
I try not to goof up when I am out with people.	O	O	O	O	O
It is important to me that I feel that I have friends I enjoy spending time with.	O	O	O	O	O
It is important to me that others think of me as popular.	O	O	O	O	O
I am often concerned that others won't like me.	O	O	O	O	O
I want to have friends who are interested in me.	O	O	O	O	O

Note. Instrument comes from the 13-item Social Achievement Goal Orientation Scale (SAGOS; Ryan & Hopkins, 2003 as cited in Horst, Finney, & Barron, 2007). The scale is a reduced version of the original 22-item SAGOS and measures social mastery, social performance-approach, and social performance-avoidance goals.

A.3 Social Network Survey

Please list the students at S[redacted]u hang out with the most, in no particular order. You do not have to fill in all the blanks. These names will not be seen by anyone at your school.

○ ***Please fill in this bubble if you don't know or hang out with any other students at this school.***

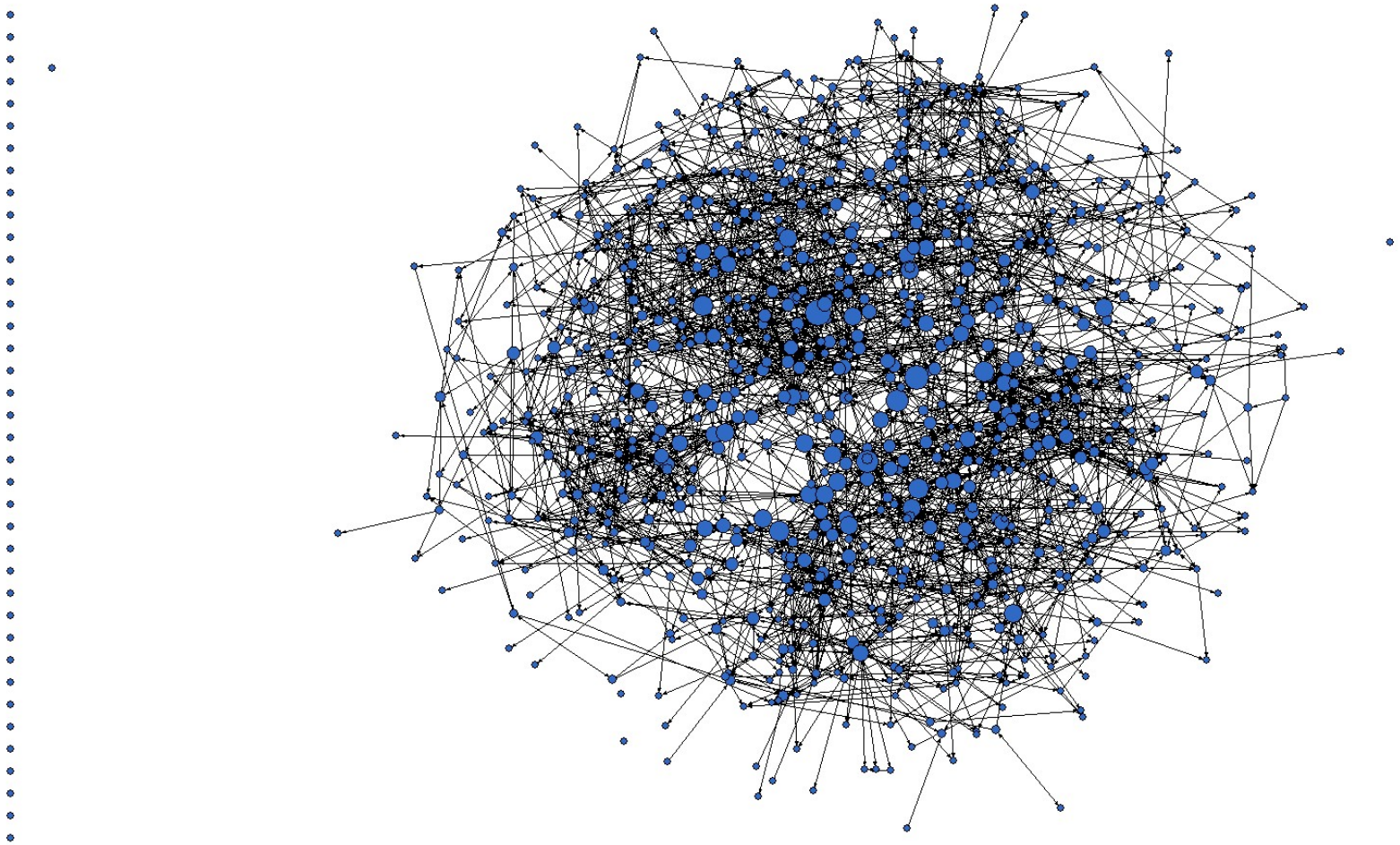
	Print FIRST name	Print LAST name
>	_____	_____
>	_____	_____
>	_____	_____
>	_____	_____
>	_____	_____
>	_____	_____
>	_____	_____
>	_____	_____
>	_____	_____
>	_____	_____

Note. Instrument was developed by reading procedures in other studies (e.g., Ryan, 2001) and through pilot testing.

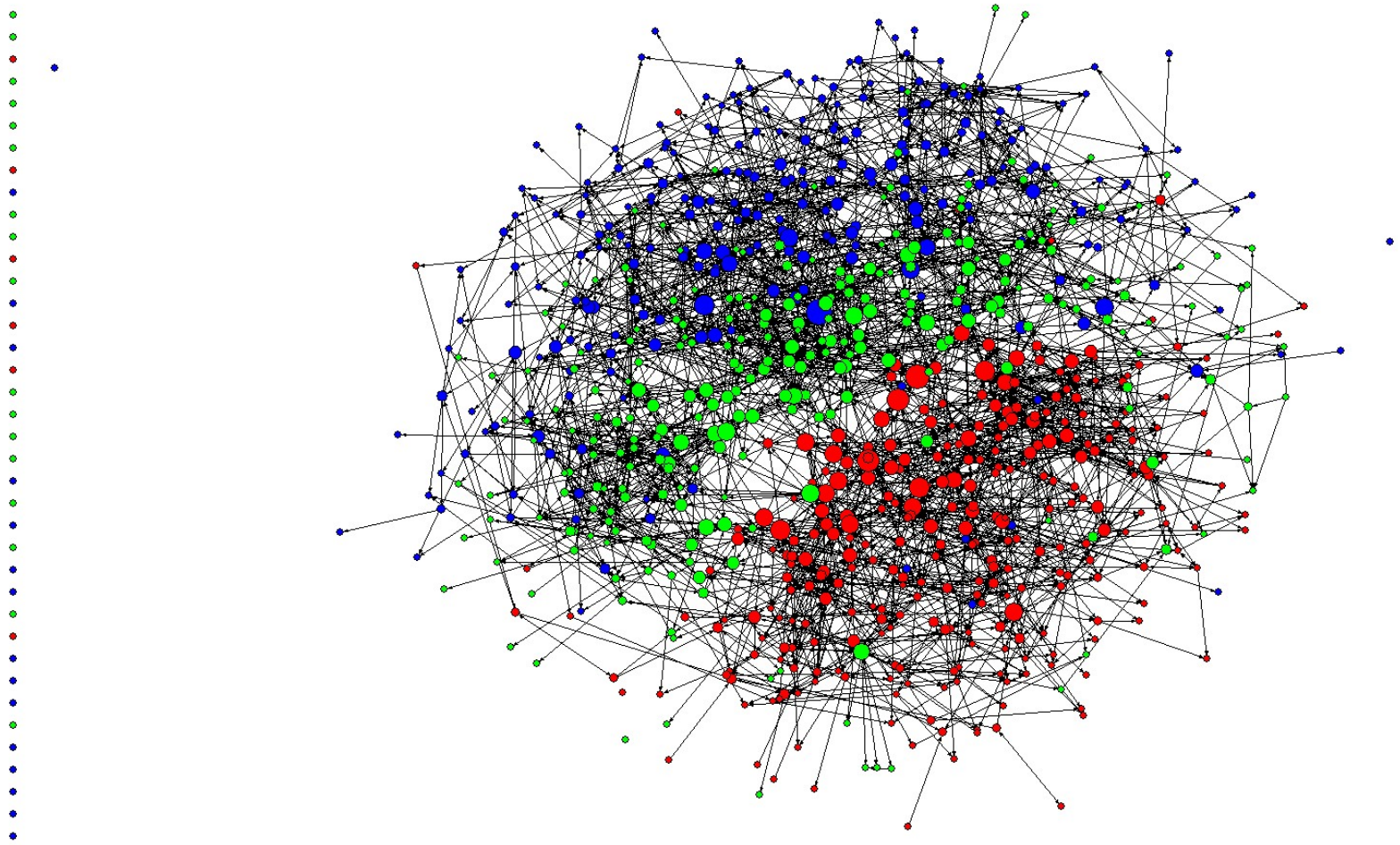
APPENDIX B

SOCIOGRAMS

B.1 Wave 2 Network Sized by Betweenness

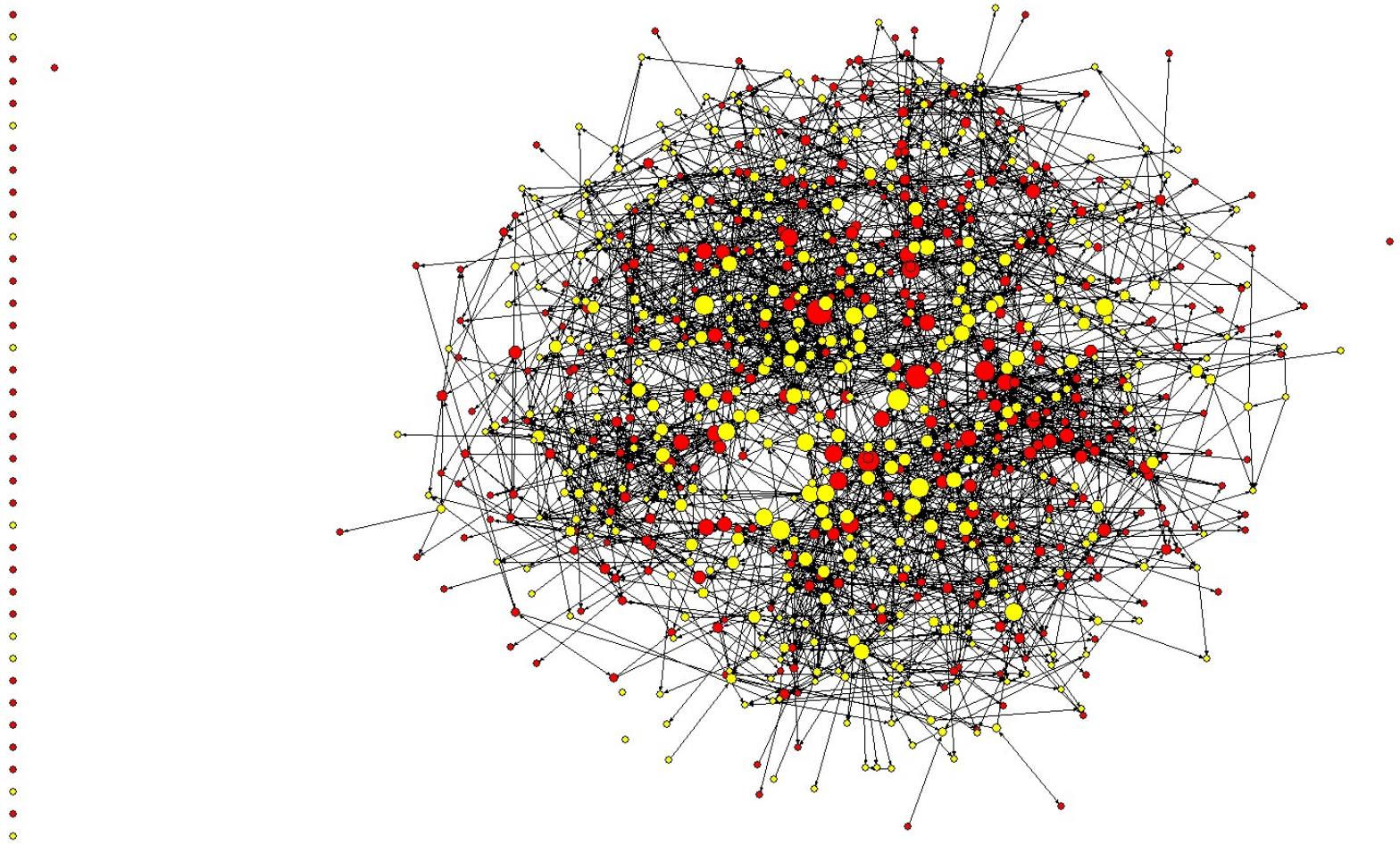


B.2 Wave 2 Network Sized by Betweenness and Node Color by Grade Level



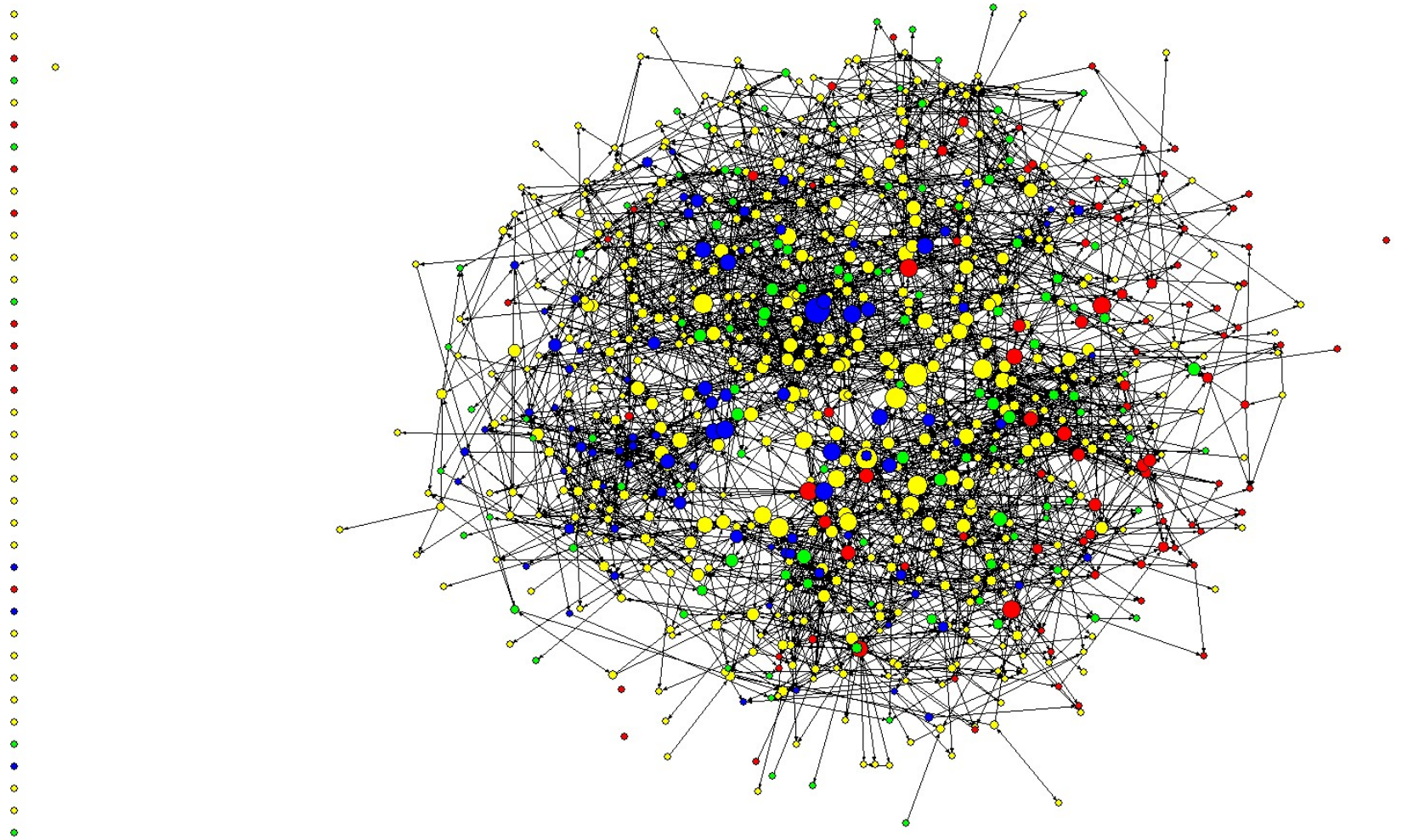
Note. Red = 9th graders, Green = 10th graders, Blue = 11th graders

B.3 Wave 2 Network Sized by Betweenness and Node Color by Gender



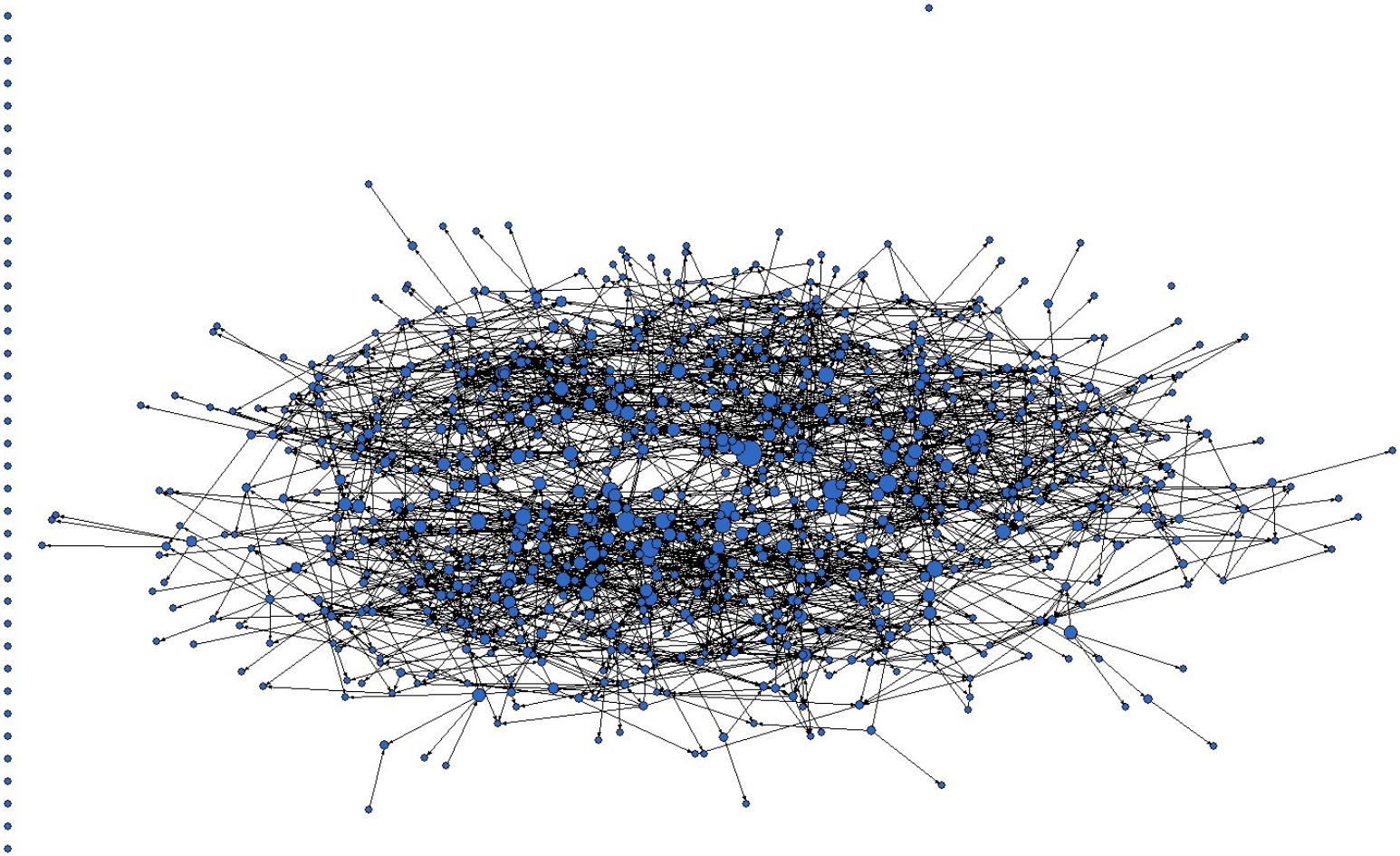
Note. Yellow = Female, Red = Male.

B.4 Wave 2 Network Sized by Betweenness and Node Color by Race

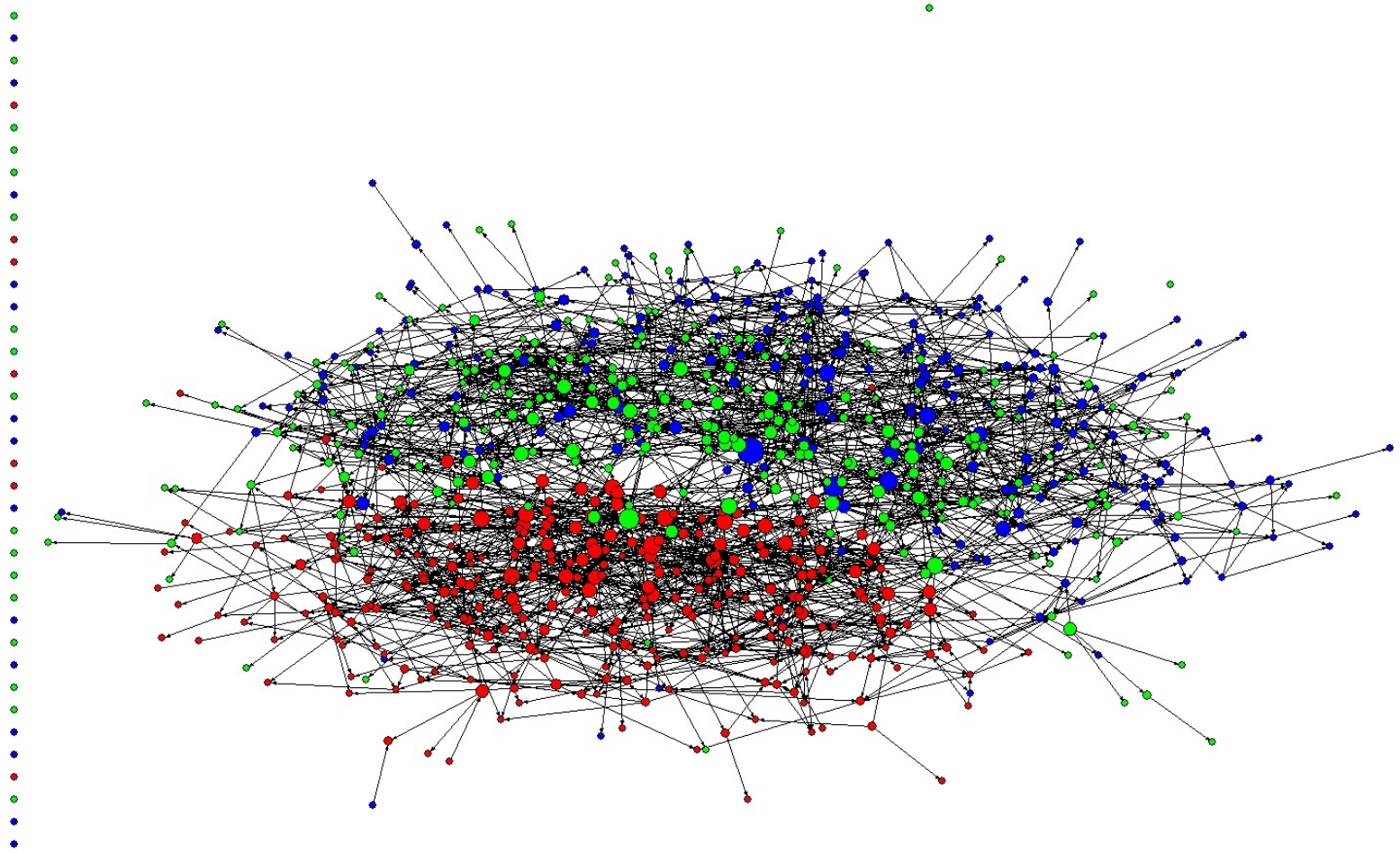


Note. Yellow = White students, Red = Black students, Blue =Asian students, Green = Multiethnic or Other.

B.5 Wave 3 Network Sized by Betweenness

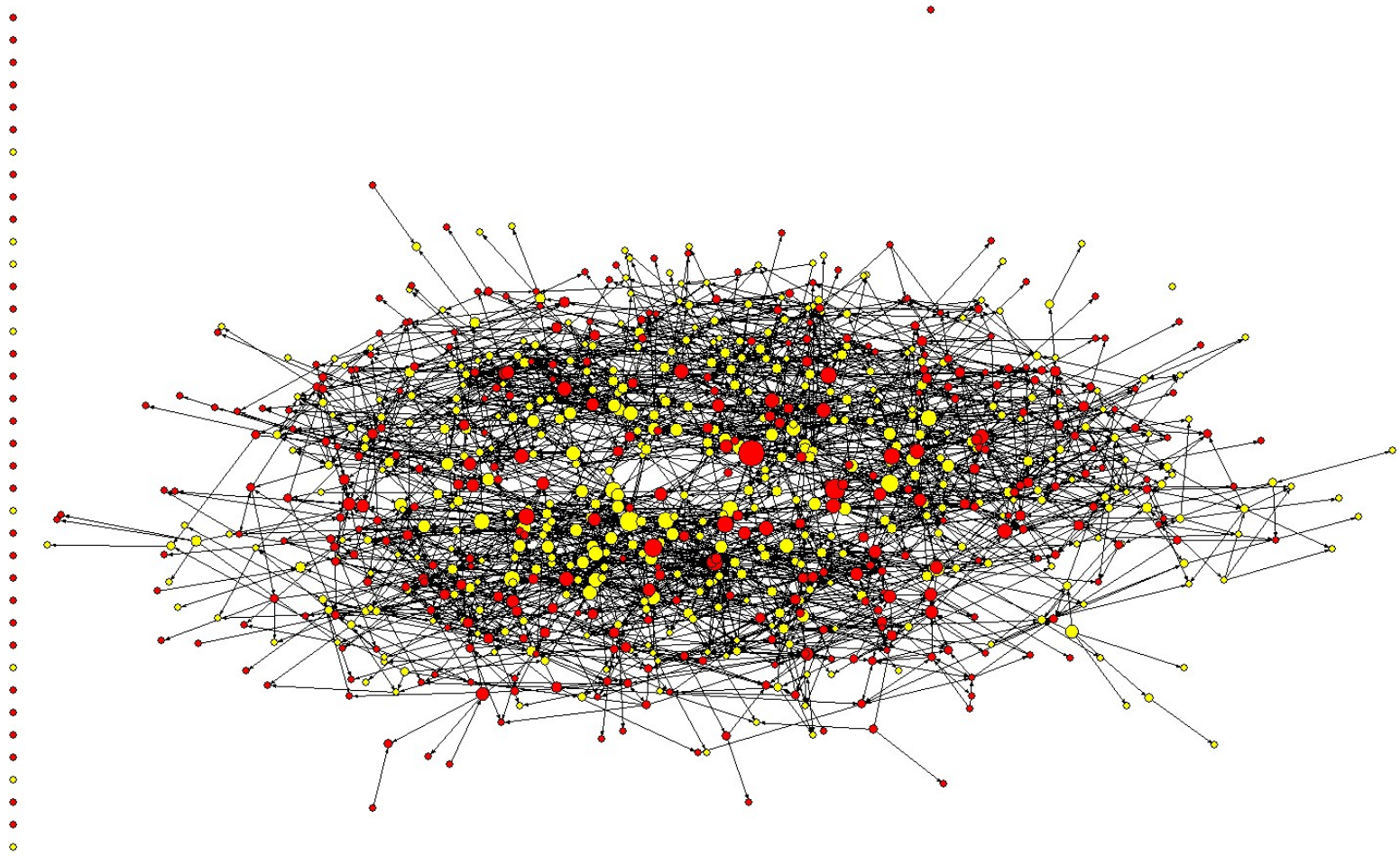


B.6 Wave 3 Network Sized by Betweenness and Node Color by Grade Level



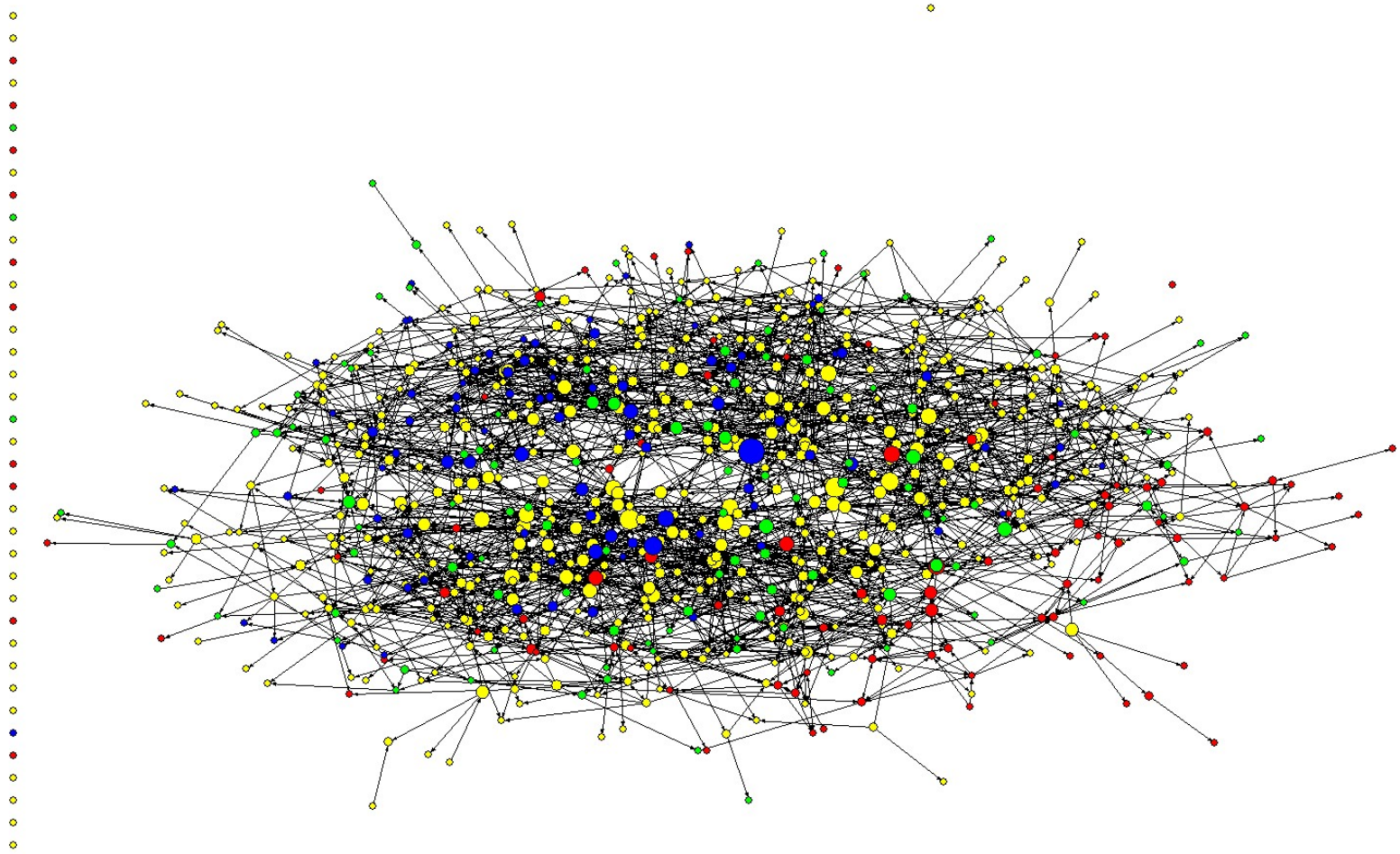
Note. Red = 9th graders, Green = 10th graders, Blue = 11th graders

B.7 Wave 3 Network Sized by Betweenness and Node Color by Gender



Note. Yellow = Female, Red = Male.

B.8 Wave 3 Network Sized by Betweenness and Node Color by Race



Note. Yellow = White students, Red = Black students, Blue =Asian students, Green = Multiethnic or Other.