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The Peer Network as a Context for the Socialization of Academic Engagement

Linda Mary Newton-Curtis
Portland State University

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The Peer Network as a Context for the Socialization of Academic Engagement

by

Linda Mary Newton-Curtis

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

Doctor of Philosophy
in
Systems Science: Psychology

Dissertation Committee:
Thomas A. Kindermann, Chair
Todd E. Bodner
Wayne Wakeland
Dalton Miller-Jones
Carol Morgaine

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Abstract

The school environment is one of the primary contexts for children's social, emotional and cognitive development. While teachers are likely to be primarily focused on students' motivation and learning, for adolescents, one of the most enjoyable and important aspects of school life is likely to be centered around the time spent interacting with peers. It is well recognized that peers socialize one another but although many studies have examined the influence of peers on adolescents' risky behaviors far fewer have focused on the influence peers may have on individuals' positive behaviors. As a result this study focuses on academic development replicating previous research designed to examine whether peer group affiliation has an effect on student academic engagement.

A cohort of 343 seventh grade students, primarily Caucasian, 52% male, was followed for a period of one school year. Teachers reported on students' academic engagement in the fall and again in spring using a 14-item scale (Wellborn, 1991), and students reported on their teachers' and parents' involvement in fall using 8- and 4-item scales respectively. Student grades were collected from school administrative records.

To identify individual student's network affiliations socio-cognitive mapping procedures were used (Cairns, Perrin & Cairns, 1985), and then peer group profiles of engagement were calculated based on the average rating of engagement across each individual's affiliates. During the academic year peer group membership turnover was 49%, despite this, the quality of peer group profiles of engagement remained similar

from fall to spring. Groups also tended to be and remain motivationally homogenous across the year. In general, girls' networks tended to be more highly engaged than boys' and networks that were more highly engaged tended to be more stable across the year.

Structural equation modeling was used for the major analyses to assess whether peer group academic motivation in the fall could predict individual motivation in the spring. The results indicated that while controlling for individuals' earlier engagement, as well as for processes of group selection and parent and teacher influences, the quality of individuals' peer group engagement in the fall was significantly predictive of students' later engagement in the spring. It should be noted that within the major models academic performance was also strongly related to later engagement. While this study provides further evidence to underscore the importance of the peer group in the socialization of students' academic motivation, particularly when one considers the snowballing effects in motivation this influence may have across a student's entire academic career, it also illustrates the important role performance may play in academic motivation for young adolescents.

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Glossary of Terms

- Assortiveness:** The formation of groups in a way that creates initial similarities in those members (similar to homophily).
- Assortative Indicators:** Those aspects of the individuals' context that would incline individuals to be similar on certain characteristics.
- Attachment Theory:** Attachment theory originated from the work of John Bowlby and Mary Ainsworth and explains the development, necessity and maintenance of affectual relationships from birth across the lifespan.
- Attractor:** “system states that can be conceptualized as locations or regions in a phase space (the space defined by possible values of global variables) toward which the system tends to evolve under a given set of contextual conditions,” (Arrow, McGrath, & Berdahl, 2000; p. 148).
- Construct:** A concept that is not directly observable but which can be tapped into through the observation of multiple correlating features that relate to the concept. For example, academic engagement as a construct might be tapped into through the behaviors and emotions a person exhibits in academic-related interactions.

Dynamic Equilibrium:	A system in which there are changes taking place while the net result of the specific system attribute remains at a constant level. In the case of peer groups, there is fairly high turnover in peers and yet engagement remains relatively stable (Kindermann, 2007).
Entropy:	The tendency of closed systems to break down and decay.
Feedback:	A situation where outputs to the system return to influence the system.
Feedback Loop:	A circular connection such that the output of a system influences the input to the system.
Goal Seeking Behavior:	This describes a system seeking to obtain or maintain itself at a certain set point or level. Tends to be achieved through negative feedback whereby the system monitors discrepancies between the goal and the state of the system.
Homophilus Relations:	Individuals who interact and are similar on a variety of background variables that brought them together.
Homophily:	Homophily is the definition given to the tendency of people who voluntarily spend time together to be similar on attributes that are relevant to them (Kandel, 1978).
Linkages:	Affiliative connections between individuals.

Matthew Effect	The Matthew effect refers the notion that the “rich get richer while the poor get poorer.” It was first used by sociologist Robert K. Merton in 1968 and was later appropriated by educational psychologists as a metaphor to describe the accumulated academic advantage students that start off well in school +tend to have over those who start poorly.
Microtime:	Continuity and discontinuity within ongoing episodes of proximal processes (Bronfenbrenner & Morris, 1998).
Mesotime:	The expansion of episodes of proximal processes and the results of the proximal processes over days and weeks.
Macrotime:	Focuses on the outcomes of development across large blocks of time, both within the individual but also extending to society and cross generational outcomes.
Open System:	A system in which there are open boundaries such that the system can exchange ‘energy’, information or materials with its environment.
Organismic:	Processes that originate within the individual as opposed to occurring in reaction to an external stimulus.
Peer Pool:	The array of possible others from which the peer network is selected.

Propinquity:	Nearness in space.
Proximal Processes:	According to Bronfenbrenner and Morris (1998), these are the primary engines of development. They are the minute by minute reciprocal interactions between an individual and social context, that occur on a relatively regular basis, and for extended periods of time.
Reciprocal Interactions:	Processes that feedback upon themselves such that a change in (a) causes a change in (b) which causes a change in (a).
Reinforcing Feedback:	A self-perpetuating cycle where a phenomenon will escalate or reduce as a result of its own growth or reduction.
Selection Influences:	Processes that determine how peers are chosen as affiliates.
Self-Organizing System:	The way in which structure or properties of the system occur as a result of interactions within the system itself rather than from pressures external to the system.
Socialization Influences:	External influences that serve to maintain or change another's behavior.
State Space:	The space of all possible system states, in other words the space of possibilities for the variable in question.

Steady State:	In the context of a system, that the behavior exhibited by a system will be maintained over time.
Tensegrity	The combining of the words of tension and integrity to describe a structure that is both flexible in its response to external pressures and yet has strength to hold itself together under stress.

Chapter 1: Problem Statement

“No problem can stand the assault of sustained thinking.”

Voltaire

There have been multiple theories and empirical investigations of academic motivation and its sub-components, but within the past 15 years or so, the construct of *engagement* as a *reflection* of an individual’s motivation has surfaced as an important and promising construct for study. During this relatively short period the concept of academic engagement has become the focus of theorists, empiricists and practitioners as being an observable manifestation of motivation (cf. Christenson, Reschly & Wylie, 2013; Wigfield, Eccles, Fredricks, Simpkins, Roeser & Schiefele, 2015), and as having the potential to ‘ameliorate low levels of academic achievement’ (Fredricks, Blumenfeld, & Paris, 2004: p. 59), through its ability to be socially influenced.

Anecdotally, when a child or youth is experienced as being ‘engaged’ (at least in the academic domain), adults expect good things to happen and this expectation has been supported by research. Engagement has been associated in the short term with academic performance and adjustment, achievement and grades, and in the long term with academic resilience, school attendance, a student’s sense of community and reduced levels of high school drop-out, (for review see: Fredricks et al., 2004).

In today’s society, engagement with learning may hold particular significance because of the escalating need ‘to keep up’ in a global community that is undergoing revolutionary change; the necessity for commitment to lifelong learning becomes key for

future and continued adult success, and the stage for this is may be set in adolescence. However, declines in motivation can be found from relatively young childhood through the end of high school (Gottfried, Fleming, & Gottfried, 2001), and may become particularly evident when teachers begin to make more performance based demands as the child enters early adolescence (Anderman & Maehr, 1994; Wang & Holcombe, 2010). Therefore, studies directed toward understanding how, when, and under what circumstances, academic engagement develops and flourishes become increasingly important.

We know that one mechanism by which development occurs is as a result of interactions within context (Bronfenbrenner & Morris, 1998). During childhood and early adolescence the primary contexts tend to be that of home and school.

With regard to the context of home multiple studies suggest the importance to children's general development of parenting interactions that are nurturing and within a structured context (Baumrind, 1989; Darling & Steinberg, 1993; Steinberg, 2001). Additional studies have produced evidence to suggest these same features are critical to a child's academic motivation, as well (Wentzel, 1997). Additionally, analogous results have been found when *teachers* employ teaching strategies that include support for warm relationships and structure as integral components of their pedagogical approach (Skinner & Belmont, 1993; Skinner, Furrer, Marchand, & Kindermann, 2008).

Most importantly peers too have been implicated in studies which underscore their significance to children's development, both good and bad. There is accumulating evidence from researchers studying the influence of peer group features such as

friendships, peer networks and peer status that suggests a link between peer affiliations and individual development. While the strength of the peer context influence is likely to fluctuate depending on the phenomenon under study, there is some longitudinal evidence to suggest that peer affiliations are implicated in the development of individuals' academic engagement (e.g., Kindermann, 2007; Kindermann & Chi, 2009). However, the context of the peer group in relation to its effect on academic motivation and/or achievement is one that has been relatively understudied in spite of its recognized significance (Ryan, 2000). Thus, many questions remain.

At the core of the problem is how to best conceptualize the nature and organization of the peer context (Brown & Dietz, 2009); a context that is complex and whose make-up is constantly changing (Kindermann, 2003). Further, questions remain regarding the degree to which socialization of academic engagement is offset by selection processes that occur during natural peer affiliation. People tend to group together based on similarity be it age, sex, looks or values, for example, and potentially academic standing is another characteristic around which individuals may also cluster (Leung, 1996). As a consequence, the effects of peer selection have to be accounted for in order to be able to justify claims of peer group socialization on academic development.

An additional problem to be addressed is that since studies are correlational in nature there is always the potential for 'third variable' causation; in other words, rather than the quality of the peer group being the 'cause' of differential academic outcomes, there is always the possibility that the teacher or parent could be influencing both (Kindermann, 2007). Thus, in any investigation of the effects of the peer group on the

individual, the methodology employed requires the sophistication to take the above considerations into account.

In sum, additional research is needed in order to investigate the effects of peers on individual academic engagement over multiple time points. Such research must employ methodology that has the ability to not only account for multiple causal effects, but is also able to parse the effects of socialization from selection. Early adolescence is a critical time for youth because academic disaffection may be potentially setting in motion study habits and curricula choices that will have lifelong impact. Hence, this is an age group upon which particular research attention should be paid.

This study aims to add to the literature by investigating the degree to which development of individual academic engagement is influenced by *naturally formed* peer groups during early adolescence. It builds upon previous research by firstly, taking as a sample, a small northeastern town's whole cohort of seventh grade children. Few studies have had the ecological validity that this approach affords. During adolescence, individuals are more socially mobile and tend to move more freely between and across classroom settings in their day-to-day academic activities, moving in multiple peer settings and with opportunities for multiple peer social interactions. Because of this, adhering to *naturally* formed peer group boundaries becomes extremely important. Only by taking the entire town of seventh grade children does this type of ecological approach become possible.

Secondly, the issue of self-selection of peer group members is directly confronted. Children have the ultimate say when deciding who to hang out with and with whom to

interact. This is particularly true in early adolescence when the individual is becoming more free to make independent decisions about the places they want to go, and are spending increasingly more time with peers. Self-selection of peers causes a variety of complications in that individuals can belong to more than one group, they can leave the group, they may join new groups. In consequence, boundaries are fuzzy and in constant flux. The methodology employed to construct individuals' peer affiliations specifically takes this issue into account.

Thirdly, peer socialization effects are examined while simultaneously accounting for 'third variable' parent and teacher influences using a longitudinal design with controls that provide the ability to disentangle peer socialization influences from peer selection. (As previously described, individuals are likely to self-select fellow group members in a way that creates similarities among group members thereby causing a confounding effect when one attempts to identify socialization effects).

These analyses provide an opportunity to investigate how and under what circumstances engagement develops thus potentially giving the opportunity to identify leverage points in the system where interventions for optimization are most needed and might be applied.

Chapter 2: Academic Development: Motivation and its Relationship to Engagement

“British educators have endorsed rewriting the works of Shakespeare as comic books with simpler language for today’s ‘bored’ students.”

(Smith, 2009: p. E3)

When considering the issue of academic development in children and adolescents it may seem logical to some to focus on performance based grades as a proxy. However this is not the only approach and indeed may not even be the best approach in understanding a child’s true academic development. For example, a teacher may diligently ‘teach to the test,’ in order to produce students who can hit certain ‘benchmarks,’ but that same teacher may also inadvertently truncate the student’s full educational experience, and thus development, due to his or her concentration on very narrow aspects of the fuller curriculum. Students themselves may mask the degree to which they have developed intellectually by ‘cramming’ for a test while having done little to fully engage with any academic materials that might have provided any long lasting facility in a given area. Other children may produce a string of ‘high grades’ and yet this may still reflect only short-term performance based outcomes rather than suggesting any kind of quality learning or widening and deepening of intellectual curiosity. In reality, grades are an assessment of performance. Intellectual capabilities vary and grades to some extent will be a function of those capabilities; however, if motivation is positively associated with educational development then this might be a

better alternative as a proxy to understanding how a child is developing across his or her academic career.

The Importance of Motivation

Teachers believe motivation is important for *quality* learning as do most parents, but, research in recent years has underscored declines in academic motivation over the course of a child's academic career as well as deteriorating attitudes towards school as the child matures (for review see: Hidi & Harackiewicz, 2000, also see Wang & Eccles, 2013). Indeed, seventh grade seems to be a particularly important time. It is then that curricula choices are being made that can have lifelong impact and when even small declines in motivation might induce a youth to resist taking a certain class or subject that would later allow for wider academic choices to be made (Anderman & Maehr, 1994). He/she is thus likely to inadvertently position him/herself along a career trajectory in which doors to opportunities are closed rather than opened.

The notion of motivation has captured the interest of many a theoretician and has led to a variety of theories of motivation that began with the Grand Theories. Instinct theories were proposed by individuals such as William James and then Drive theories by psychologists such as Sigmund Freud. More modern theories of motivation incorporate constructs that seek to illuminate the many and varied *sources* of motivation such as needs, self-efficacy, control, values and expectancies, beliefs and attributions or internal versus external motivations.

Internal Versus External Motivation

Individuals can be motivated because they place an inherent value in an activity, entirely for its own sake, or alternatively because they want to attain some outcome that is separable from the activity itself (Deci & Ryan, 1985). In a class of students for example, one might read everything to do with a certain era in history out of pure inherent fascination with the subject while another will read only what is necessary in order to attain a good, or passing, grade in a test. One student is acting out of intrinsically motivated behavior finding enjoyment purely in and of the activity itself. The other will have to employ self-regulatory processes, or perhaps a system of internal rewards and punishments for example, in order to comply with what is necessary in order to obtain the passing grade: S/he is extrinsically motivated. The outcome s/he wants to attain is separate from the action necessary to achieve the goal. Deci and Ryan (2000), propose that the degree to which behaviors are self- or nonself-determined, in other words internally versus externally controlled, will be associated with whether or not motivation is intrinsically or extrinsically driven¹. The two types of motivation are qualitatively different and are associated with different experiences and outcomes. For example Ryan and Connell (1989) found that the more *externally* motivated children were shown to be, the less interest they exhibited, and the less value they placed on achievement.

Comparisons of individuals whose behaviors are internally controlled, with those whose behaviors are externally driven, suggest that more interest, excitement, confidence and well-being is shown by those who are *intrinsically* motivated (Ryan & Deci, 2000). Intrinsic motivation is considered 'authentic' in that it comes from within, and is 'self-initiated.' The act is conducted for its own inherent satisfaction. Children from their

earliest times show intrinsic motivation in their self-initiative to explore, to discover, to interact. There is an inherent satisfaction to be had in obtaining mastery over the environment. This organismically driven, intrinsic motivation is important because ultimately it is key to optimal cognitive, social and physical development. That a child, youth or adult *wants* to engage with their environment is key to maintaining optimum vitality. Ryan and Deci (2000) view intrinsic motivation as an ‘innate propensity.’ It is within us all but may be optimized or degraded by the supports, or lack thereof, in the environment within which the individual is embedded.

As children grow, there are many actions in their day that are born out of extrinsic rather than intrinsic motivation, thus it is important that the values associated with those behaviors become internalized by the individual such that they become a part of the self. This might take the form of doing homework on a regular basis as a matter of course, knowing that this is important, it is what one does and is congruent with the self even though it may not be intrinsically enjoyable or particularly interesting. And, since these actions may not be interesting or enjoyable, one of the reasons individuals may engage with them is because of their value to significant others who are important; those to whom they are attached (Ryan, Stiller, & Lynch, 1994). Thus the quality of *relationships* with significant others are of importance, when the significant other values a behavior that is not, in its own right, intrinsically motivating to the individual him or herself.

Motivation to action is also predicated upon the perceived ability, or competence an individual feels. There is little point in acting upon something if developmentally one is not at a stage where one can achieve at least some measure of success with the activity.

Thus it has been proposed that an optimal environment for the development of motivation should include supports for autonomy, relatedness and competence.

The self-system model of motivational development. The self-system model of motivational development (Connell, 1990), proposes that motivation is optimized when the individual's social context affords the individual the opportunity for the fulfillment of certain fundamental psychological needs (see Figure 1). As a consequence, actions, both behavioral and emotional, will be energized. These actions will reflect the quality of the person's motivation.

Essential to this model is the idea that each person has an inherent psychological need for,

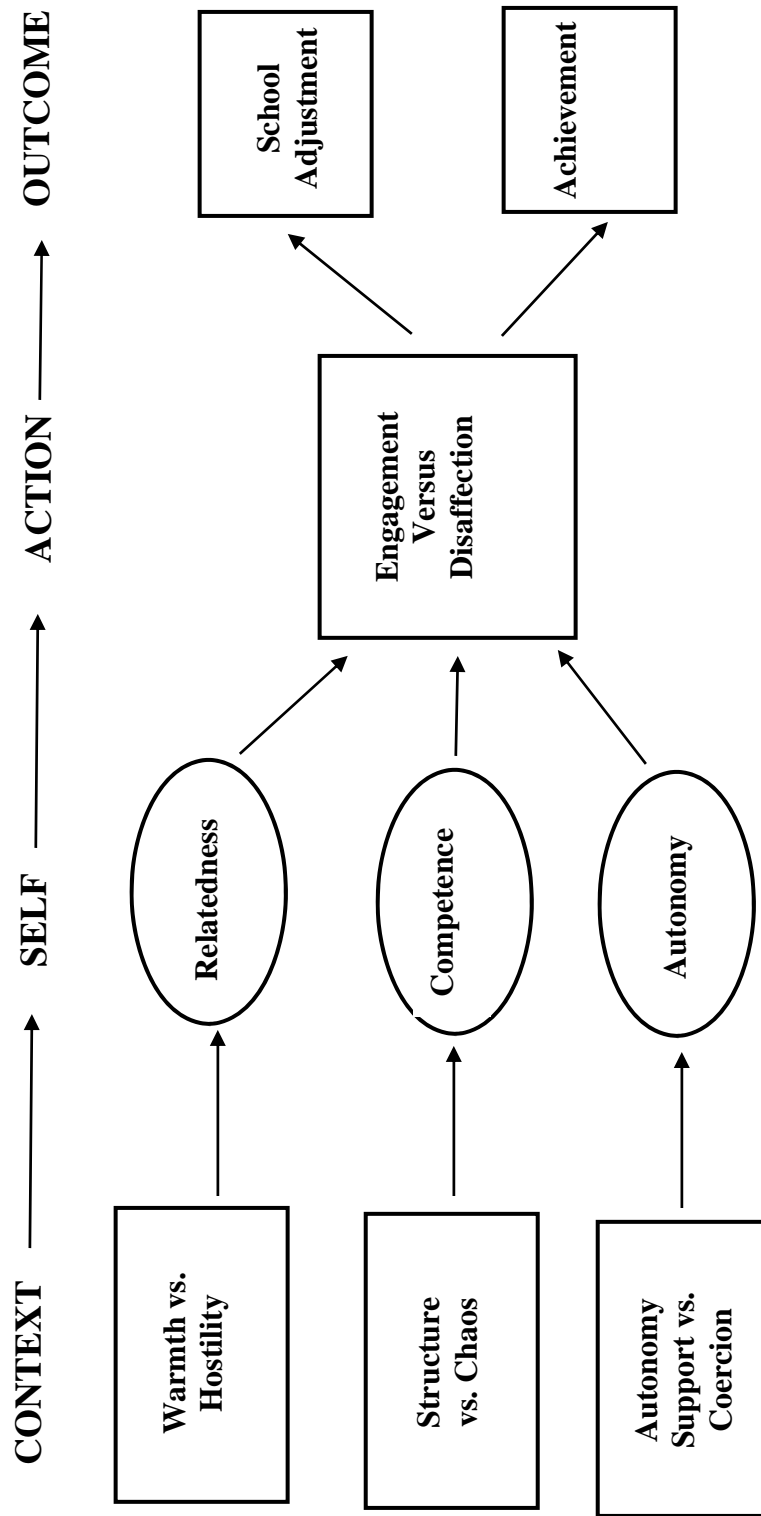
1. **Autonomy:** The opportunity to pursue self-initiated, self-determined and self-regulated goals as opposed to goals that are 'stuck on' or driven by some external force.
2. **Relatedness:** The feeling of connection with those around him/her, which enhances his/her sense of wellbeing, and feelings of worthiness – derived from attachment theory.
3. **Competence:** The ability to be effective within the environment and/or chosen endeavor, an understanding and knowledge of how to control the environment, to produce desired results.

It is with the fulfillment of these needs that the individual will be optimally engaged within the particular context, exhibiting behaviors that are effortful and focused, together with positive emotions, for example, of curiosity and interest. As such the

individual will be actively engaged (or motivated). The relationship with the environment is one that is transactional. Self-system processes, the ongoing and constantly developing consequences of self-appraisal in relationship to the enterprise at hand, will reflect the degree to which the person feels a sense of being able to control his or her environment and an understanding that what s/he does makes a difference to the ultimate outcome; that s/he is allowed to demonstrate the “authentic self” and that s/he is able to choose rather than be coerced into goals; and lastly security in the self as being accepted rather than isolated or neglected.

However, social contexts can both promote or undermine these three needs and thus promote or undermine motivation. When psychological needs fail to be met or are hindered then the person is likely to become disaffected, or will become passive, give up easily, and show negative emotions such as anger, fear or anxiety. The self-appraisals manifest as patterns of engaged or disaffected action that can be readily observed by others such as teachers, parents and peers, “in the ‘flow’ of ongoing activity as well as reactions to challenge,” (Wellborn & Connell, 1991).

Figure 1: Self-System Model of Motivation (Connell, 1990).



Engagement as a Reflection of Motivation

One way to think about motivation is as goal-oriented, directed energy (Ainley, 2004; Frydenberg, Ainley, & Russell, 2005). When we are motivated, we are motivated to *do* something. We direct our energy toward some goal that we believe is meaningful. When we are motivated we have a propensity to *engage* with the problem, task or challenge at hand. Thus, engagement as a construct can also be considered a reflection of motivation and can be observed in behavioral terms by our commitment to the task, the persistence we show, the tenacity and our reluctance to abandon the task until the challenge has been met. It is also demonstrated by our emotions in the *quality* of our interactions - the satisfaction found in small gains, the fun and enjoyment we have in the process of attacking the task. In one way or another, with engagement (or disaffection), there is *action*. “Engagement and disaffection are the action outcomes of motivational processes,” (Skinner, Kindermann, Connell, & Wellborn, 2010).

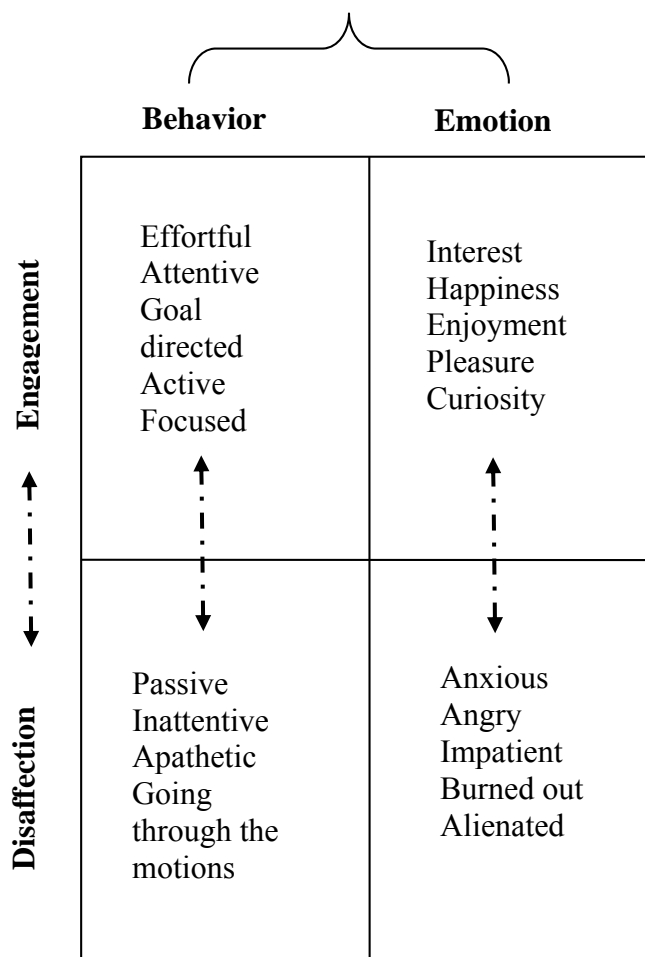
The quality of one’s engagement might be explained as an attribute of motivation, an emergent property, that is shown by the type of interactions demonstrated and experienced. It might also be described as the quality of *connectivity* between person and activity that promotes learning and development (Ainley, 2004; Frydenberg et al., 2005). As a result, engagement and its counterpart disaffection have both a behavioral and emotional component to them.

Engagement as a Construct

Fredericks and colleagues (2004) in their seminal work suggested that engagement is a metaconstruct with fuzzy boundaries which, thus, incline conceptual clarity of the concept to suffer. Indeed, the notion of engagement has been applied in

many ways but one of the most thoughtful attempts offered in the conceptualization of the construct of engagement and in the development of an instrument to measure the construct came about in the early 1990s (Wellborn, 1991). Wellborn's concept of engagement employed a model of engaged versus disaffected *action* (see Figures 1 and 2). From his perspective, behavioral action born out of motivation would consist of directed effort and/or persistence in interacting with a task. His discussion of emotion as a reflection of motivation suggests that emotions constitute action "to the extent that these experiences reflect appraisals (Wellborn, 1991; p. 33)." Thus, motivated emotion could include feelings such as anger, interest or boredom *in an interaction*. From this perspective engagement consists of 'patterns of action,' behavioral and emotional, around tasks and disaffection would suggest 'patterns of action' structured around a goal of minimized contact or non-performance with a task. Research has demonstrated that this conceptualization of engagement has predictive value for children's academic development (Kindermann & Skinner, 2009; Skinner, Wellborn, & Connell, 1990). And from a pragmatic perspective this conceptualization has value because it is an outward manifestation that can be readily and easily observed (Skinner & Belmont, 1993; Skinner, Kindermann & Furrer, 2009).

Figure 2. Features of Behavior and Emotion Encompassed in Student Engagement/Disaffection



The Importance of the Engagement Construct

Figures 1 and 2 suggest that the quality of one's engagement, or the degree to which one is academically positively energized, would have consequences for academic achievement, as well as skills and school adjustment. This has been borne out by several studies. For example, in a study consisting of 220 students in grades three through six (Skinner et al., 1990), researchers used path analyses to investigate the associations between teacher reports of student engagement, grades and standardized achievement scores. A positive relationship was found, higher engagement was related to higher grades. This positive association between academic engagement and achievement has also been empirically demonstrated by other researchers (e.g., Connell, Halpem-Felsher, Clifford, Crichlow, & Usinger, 1995; Connell, Spencer, & Aber, 1994; Jimerson, Campos, & Greif, 2003).

Connell and colleagues (1995), used path analyses, in a longitudinal study, to understand the relationship between academic engagement and academic 'at-risk' behaviors, and school drop-out in a sample of 443 African American students. These students were split fairly evenly by sex and were in grades seven through nine. The results suggested that engagement in Fall was negatively related to being flagged 'at-risk,' measured in Spring. In other words students who exhibited higher levels of engagement in the Fall were shown to be less likely to be flagged for 'cutting class,' achieving below the 40 percentile mark on reading and math, being suspended, failing courses during the academic year, or being two or more years older than the average age for that particular grade. Further, for males, academic engagement was related to remaining enrolled in school three years later. Lower engagement has also been linked to

grade retention in school. Pierson and Connell (1992) compared 74 students, grades three through six and who had been retained a grade, with children who were randomly chosen from those who were a match in terms of sex and grade. Analyses of variance demonstrated a significant mean difference in engagement between those who had been retained and those who had been randomly selected from the pool of other children. More recently Li & Lerner (2011) in a longitudinal study of 1,977 students across grades 5 to 8 exploring the correlates of differing behavioral and emotional engagement trajectories found high engagement to have a buffering effect against depression, delinquency and substance use.

Engagement and disaffection are person attributes that are easy to see and tend to be noticed by those around (Skinner et al., 2010); an individual's quality of engagement or disaffection seems to promote those around him or her to react in response to the behaviors and emotions projected by the student. For example in a longitudinal study of 144 students aged eight through twelve (Skinner & Belmont, 1993), researchers used correlational and path analyses to investigate the relationship between students' engagement in the Fall and the teacher's behavior in Spring. These researchers found evidence to suggest that the quality of the students' engagement in Fall predicted the contextual supports provided by the teacher, as measured in the Spring. Students who were highly engaged perceived more warm involvement from their teachers, more support for autonomy and more consistency; these are contextual supports that feed back into the individual's own engagement, or lack thereof, over time (Connell, 1990; Connell et al., 1995; Furrer, Skinner & Pitzer, 2014).

Others have also found that engagement can be manipulated through contextual support in a study of 805 students in fourth through seventh grade, researchers found evidence to suggest that teacher support was related to improvements in emotional and behavioral engagement, and declines in behavioral and emotional disaffection across time (Skinner et al., 2008).

In sum engagement is an important construct in several ways. Firstly it has been found to be related to short term outcomes such as academic achievement. This means when all else is equal, if one is highly engaged one is likely to do well in terms of short-term achievement. Secondly, it has been related to longer term outcomes such as reduced school alienation and reduced likelihood of dropping of school. The reduction of these types of long-term outcomes is something that many school districts would like to see. Thirdly, it reflects patterns of action that can potentially be manipulated with interventions. Lastly, from a practical standpoint it is also easily identifiable by observers and thus pragmatically it is important in the ease of its use.

Chapter 3: The Peer Group as a Context for Development

*“Byrdes of on kynde and color flock and flye allwayes together”
(Turner, 1545)*

A child has no choice when it comes to who his or her parents are. S/he has very little say in who his or her teachers will be, but association with peers is different. Choice is far wider and often far more dependent on the child.

According to the Oxford English Dictionary (*The Oxford Essential Dictionary: American Edition*, 1998) a peer is a person who is equal in ability, standing, rank and value: a contemporary. As such, child peer relationships have long been considered to be important to development. It is with peers, for example, that a child learns to negotiate with equals, to share, to compromise, to ‘stand up for him/herself,’ or to experiment by taking different roles in play and so forth (Piaget, 1965). Vygotsky emphasized the cooperation and discussion amongst children that promotes development (see Bukowski, Brendgen, & Vitaro, 2007). Being with peers is fun. In a survey of high school students, researchers asked the question “why do you go to school?” one of the most common responses received and submitted by 68% of students was, “because of my peers/friends,” (Yazzie-Mintz, 2009): children and youth tend to enjoy the time they spend with peers (Larson & Richards, 1991; Narayan, 2010) and as they approach adolescence feel a freedom to talk about things they would never dream of discussing with parents or teachers. They start to share their innermost thoughts and feelings, in a way and with language that might not be used with adults (Stanton-Salazar & Spina, 2005). An opportunity is provided when with a peer to develop skills and to enhance competencies

that become the foundations for future relationships (Hartup & Sancilio, 1986; Parker, Rubin, Erath, Wojslawowicz & Buskirk, 2005). In short, the social experience of interaction within the peer context is one that provides very different, and very important, developmental opportunities from those experienced with adults.

Bronfenbrenner proposes that the proximal processes associated with social interaction are the ‘engines of development’ (Bronfenbrenner & Morris, 1998). When we consider that children in the U.S. typically arrive at school somewhere between 7:30 to 8:30 in the morning and often do not leave until mid-afternoon, perhaps even later if s/he is involved in some kind of extra curricula activity such as a homework club, or science and engineering club and so forth, then it would seem that peers have the potential to be very influential on the developing *student* and, indeed, this influence is likely to increase towards adolescence with the increasing time spent together both in and out of school. At least one theoretician would suggest that peers are the *primary* influence (in combination with the child’s genetics) on an individual’s psychological development. Harris (2002), provides the compelling example of newly immigrant children who are often able to quickly learn the language and social norms of the dominant society even when adults in the family do not speak the adopted country’s language. The children learn from their peers (Harris, 2002).

Parents, too, have long understood the influence of peers on their sons and daughters and many would, no doubt, acknowledge their own attempts to manipulate who their children associate with by, for example, allowing certain children to “sleep over,” while discouraging others, or offering to carpool certain children to school or sporting

events, or ‘helping’ their child to pick who is to be invited to the birthday party or the weekend camping trip. As time goes on, some arguably more protective or more intrusive parents might track computer social networking use, cell phone use and so forth. The fact is, parents think some ‘kids’ are a good influence and that others are not. This parental belief is also echoed in many a classroom by teachers who may try to suggest work partners who they believe to be a ‘good’ influence or move other children they believe to be a ‘bad’ influence.

Indeed, across the board, much pre-adolescent and adolescent research has been focused on negative peer influences (e.g. Bendixen, Engdresen, & Olweus; 2006; Weerman, Bernasco, Bruinsma & Pauwels, 2013). For example, there is convincing longitudinal research that suggests adolescent problem behavior such as use of tobacco and teacher-reported externalizing behavior is rooted in peer group delinquency training. These effects have even been shown when the group of peers had originally been gathered together for professional *intervention* training (Dishion, Poulin & Burraston, 2001). Use of alcohol to intoxication has also been associated with peer influence (Urberg, Degirmengioglu, & Pilgrim, 1997), as well as drug use (Oxford, Harachi, Catalano & Abbot, 2001). Steinberg and colleagues (2011, 2014), designed a variety of interesting experiments in recent years to explore adolescents’ propensity to engage in risky behaviors when alone versus when in the company of peers. In the first experiment, adolescents were given a simulated driving task in which they had to make a decision about whether to go through a series of timed yellow lights thereby risking being ‘hit’ by an unseen car coming through the intersection. The results of this experiment led

researchers to believe that adolescents are equally able as adults to assess the risk of this action because youth were no more likely than adults to run the lights when ‘driving alone.’ However, when young adolescents were given the same test with two peers in the room they were twice as likely to risk running the lights compared with those who were alone – this indicating the influence peers may have by simply being in the vicinity of other same-age peers (Albert & Steinberg, 2011). And in another experiment, this time exploring adolescents’ likelihood of gambling, youth were more likely to gamble when they believed they were being observed by a peer in a separate room than when they believed themselves to be alone, even when they knew the possibility of winning was low (Smith, Chein & Steinberg, 2014; Weigard, A., Chein, J., Albert, D., Smith, A. R. & Steinberg, 2014).

However, the research around peer influence is not restricted solely to risky behaviors and negative consequences. For example, Wentzel and Caldwell (1997), found a positive relationship between peer acceptance and adolescent social-emotional adjustment as well as academic achievement. Similarly, in a longitudinal study from 7th to 8th grade Wang & Eccles (2013), found that peer emotional support was positively related to behavioral and cognitive engagement. Nonetheless, far less work has been conducted to around the positive influences peers may have, or to examine how and under what circumstances adolescent peer groups exert these positive influences.

Conceptual and Methodological Challenges in the Assessment of Peer Influences

History shows that interest in peer groups dates back to as early as 1904 with Terman’s research on leadership and suggestibility. But it was after WWII that researchers began to shift their focus to peers as a *socializing agent* that could have an

effect on academic achievement (Ide, Parkerson, Haertel, & Walberg, 1981). One of the challenges in studying peer influences at that time was, and continues to be, how to conceptually define the notion of ‘peer group’ For example Brown (1990) remarks that the label of ‘peer group’ has been given for relationships as diverse as those of dyadic friendships to those that entail connections to a whole cohort of children. Further, once a common understanding of the definition of peer group has been attained the second problem then becomes, methodologically how to measure it.

Peer Affiliations

A review of the literature suggests three major directions that have been taken in the research around children/youth and their peer affiliates: The first is based in social categories: the study of social status (e.g. Coie & Dodge, 1983) or crowds (e.g. Brown, 1989). The second direction has been in the study of friendships (e.g. Berndt, Hawkins, & Jiao, 1999). The preceding approaches have examined related antecedents and consequences. More recently the study of networks of peers and their influence on children’s developmental outcomes has gained attention (e.g. Kindermann, 2007). The following provides a brief overview of each method, findings related to the method and critiques associated with the method.

Social Categories

Crowds. One traditional way to define groups of peers has been to assign a ‘social type rating’ in order to identify ‘crowds,’(e.g., Brown, Mounts, Lamborn, & Steinberg, 1993). This, quite complicated approach involves the assignation of a person to a social ‘crowd,’ based on the adolescent’s reputation. This method was used by Brown and colleagues (1993), in order to understand the association between parenting

practices and peer affiliation. Using a two-step process, in this study, school administrators were first asked to identify students who represented a cross-section of the student body. Small focus groups of the nominated students were then gathered together and through discussion each group generated a list of the school's major 'crowds.' The adolescents next nominated two males and two females who were deemed to be the most prominent within each crowd. The most frequently listed 'prominent' crowd members were employed as social type raters in step two. In the second step raters were provided with names of the crowds that had been identified in the previous step (Popular, Jock, Brain, Normal, Druggie, Outcast), and asked to nominate every student within their grade level to one or other of the crowds.

Research suggests there are at least concurrent correlations between the crowd one belongs to and outcomes such as self-esteem (c.f., Berndt, 1992; Sussman, Pokhrel, Ashmore & Brown, 2007), and longitudinally, it was also shown to predict achievement, school adjustment and emotional experience in an Australian study of 874 students (Heaven, Ciarrochi & Vialle, 2008). But a critique of this method is that individuals who have been identified to the respective crowds may, or may not, directly associate or interact with one, they are linked simply by reputation; individuals are categorized based on stereotypes about behavior and personality (c.f., Kindermann & Gest, 2009), and so it does not specifically address peer affiliation in terms of linkages between peers.

Social Status. A second approach has been to assess how well liked or disliked an individual is across the group, typically a classroom of children, thus assessing the individual's social acceptance.

In most instances, the researcher will ask children who they most like/dislike, or, perhaps, who they would most like/dislike to sit with or play with. Following on from this is then the researcher-driven algorithm that results in a mutually exclusive categorization of each child as being popular, rejected, average, controversial or neglected. This categorization allows researchers to discriminate individuals with low acceptance due to total rejection from those who seem 'invisible' to the group; in other words, those who are neglected. These can be further discriminated from those who have mixed reputations and are deemed 'controversial,' in other words, children who are very well liked by some and very disliked by others. Being rejected by one's peers tends to be related to more negative behavioral concurrent correlates as well as more negative outcomes in later life such as school withdrawal, delinquency, and psychopathology for those children exhibiting aggressive tendencies although not for those with passive behavior attributes. (see Bagwell, Newcomb, & Bukowski, 1998 for review).

Conversely, being well-liked, or popular, tends to support more optimal developmental outcomes (Guay, M., & Hodges, 1999; Hartup, 1996), such as school achievement and motivation (Bagwell et al., 1998; Guay et al., 1999), or getting along with one's peers and teachers, for example. More recently researchers have included two additional questions: "who is most popular" and "who is least popular," (Cillessen & van den Berg, 2012).

This allows students to be assessed based on two dimensions simultaneously, that of being liked or disliked as well as being popular or not – giving rise to a different form of popularity known as 'perceived-popularity.' Youth with perceived-popularity have prestige but may not be liked by classmates. Research suggests that these individuals use

prosocial, as well as relationally aggressive methods to attain goals. Very little research has been focused on longer term outcomes for these youth although in the short-term it seems that their behavior may result in immediate rewards without negative consequences (Cillessen & Rose, 2011). While the methodologies used to categorize youth in these ways are relatively easy to implement, from this perspective, processes of interaction are not given priority as a contributor to a child's development but only one's social status across a group, from the perspective of the group. Although in recent years the work involving social status and its relationship to social and emotional competence has become more complex as it evaluates links between subsets of the original categories and their correlates, it is, nonetheless, a 'static' measure that does not speak to the complexity of the *context* in which development occurs, or affiliative connections. While being accepted or rejected would clearly be influential to development, this approach does not address the issue of *who* you are accepted or rejected by or the quality of proximal processes that drive the development within such a relationship, even a rejecting relationship, would be. Nor does such an approach speak to the structural characteristics of the peer group and how that would affect the development of the individual. Indeed, little focus is devoted to the complex issues around studying children in groups (Bagwell et al., 1998).

In both of the methods described above, crowd categories and social acceptance categories are identified independently from the children that are being studied. For those children who are described in terms of being popular, rejected and so forth there may be no relational ties to one another at all, and in terms of the children assigned to 'crowds'

there may be only 'ideational' ties at best (Kindermann & Gest, 2009). In sum, the above methods categorize adolescents as 'types' rather than group them based on interactions or direct affiliation between adolescents is not taken into account.

Friendships. Researchers who investigate friendships and the effects of friendships call attention to the fact that development not only depends on degree of acceptance a child maintains but also the reciprocated interactions that are entailed. One has an affective relationship with a friend. Friends are valuable in that they provide opportunities for skill building, prevent loneliness, provide social support and promote a sense of well-being and self-esteem. Friendships are founded on matters of trust, cooperation, are voluntary and tend to be enduring. They are not assigned by others as crowds and categories of social acceptance are. A friend may be inclined to feel a level of guilt if s/he betrays the expectations of the friendship (Bigelow, 1977). But, not all friendships are positive for example the quality of adolescent friendships has been associated with truancy and fighting (cf. Wentzel, Donlan & Morrison, 2012), and having friends with antisocial characteristics can reinforce the individual's own antisocial tendencies (Dishion, Andrews, & Crosby, 1995). However, research around high quality friendships and academic outcomes have found evidence suggesting positive relationships with both academic motivation and achievement (Altermatt & Pomerantz, 2003; Berndt, Hawkins, & Jiao, 1999; Wentzel, McNamara-Barry, & Caldwell, 2004).

Investigations of the effects of friendships on child psychological characteristics and outcomes have traditionally depended on children's self-reports of who their friends were. Potential problems with this methodology have been highlighted by several

researchers who suggest that children might be likely to exaggerate the sheer number of friends they have, exaggerate their affiliation with 'popular' students or name peers that they would *like* to have as friends rather than those who are friends. (Cairns & D., 1994; Leung, 1996), thus distorting information. As a corrective response, researchers often establish the validity of the nominated friendship by comparing reciprocity of nomination between individuals.

The downside to this approach is that in cases where an individual is not available as a respondent, for example s/he is ill on the day of testing, or the researcher does not have consent for study participation and so forth, reciprocation of nomination cannot be authenticated, thus, potentially causing a large attenuation of friendship dyads. And although to some degree one can get around this problem by using observational techniques, depending upon the criteria used, friendships may still, nonetheless, be under- or over-reported. For example parents and teachers may not be privy to friendships the individual tries to hide or may themselves misreport supposed friendships with children the adult would like their child to be friends with.

A further disadvantage is also that any potential friendship is reduced to a dichotomized yes/no friendship dyad, whereas in reality, friendships are probably on more of a continuum from acquaintance or casual friend to close friend (Gifford-Smith & Brownell, 2003). Further, in most cases children are only asked to nominate two or three close friends and, thus, social partners who may be influential to development are excluded from analysis because they are unobserved or fail to fall into the category of 'best friend.' Constraints on the number of children who can be nominated as a close

friend can also lead to problems when attempting to assess friendship stability over time. For example a child who has more than the researcher designated one, two or three ‘best’ friends may choose to nominate different friends as the ‘best’ ones during subsequent follow-up testing sessions despite remaining closely affiliated with the originally nominated ‘friend.’ Children are notorious in their attempts to ‘be fair’ and might only consider it fair to nominate ‘Scott’ and ‘Brent’ this time because last time they nominated ‘Nick’ and ‘Sam.’

One way to address these problems may be to *objectively* investigate *publicly* known groups of children who are known to spend time together. In other words, identify the networks of children that are known to *associate* and *interact* together without placing pre-ordained artificial constraints on the number of relational ties an individual child may have, or constraining the ‘type’ of person the child might *be* as in the previously described categorical techniques.

Social networks and their importance. A basic assumption of research investigating the effects of naturally formed groups of peers on individual children is that students develop within a peer group that has a structure and is publicly observable (Kindermann, 1996; Kindermann, McCollam, & Gibson, 1996). No-one ‘assigns’ naturally formed groups of peers to be together - they mingle and do things together because they want to do so. They regularly engage in activities together or just like to spend time in one another’s company. They are self-organizing groups that are dynamically changing over time in their make-up (Kindermann, 2007). Consequently, there is the possibility of constant turnover as some members leave the network and

others join. In fact, one study (Kindermann, 1993), indicated that over a period of an academic year there was a 50% turnover in group membership. Nonetheless, the motivational composition of the group maintained in dynamic equilibrium.

There may be overlap between friends, social status and peer networks but because the inclusion criteria is different, overlap is not something that would automatically occur (Kindermann, 1996). Friendships may be embedded in the network or may grow out of the network associations. For example, previous studies have shown that for children in 4th through 7th grade, between 42% to 82% of their self-nominated friends were observed as members of the individual's social network (Kindermann, 1996). While the research on social status and friendships has a long history, research investigating the effects of the peer network on individual development is much less mature. This may be because of the complexity in measuring an entity that is constantly in flux. Cairns and colleagues (1998), nonetheless, suggest that to be constrained by constructs such as popularity or friendships leads to “a piecemeal approach that Bronfenbrenner described as ‘insufficient and misleading’.”

Research on peer groups and their influence on the individual has been important to adding to our understanding of individual academic outcomes. For example, children who have good relationships with peers tend to be more engaged with academic tasks (Wentzel, 2009).

When considering development, an inherent implication is that there is a process by which this occurs and one mechanism may be through peers' socialization influences. For example, in one small classroom sample of 22 fifth grade children, where social

network influences were observed, changes in engagement across time were predicted from the approval or disapproval for on and off-task behaviors from peers in the classroom (Sage & Kindermann, 1999). Sequential analyses provided evidence to show that those children who were highly engaged tended to receive more contingent support for their on-task behavior from their respective peer group members than those children with low engagement scores. In fact, only teachers supported the on-task efforts of children with low engagement and then at a seemingly lower rate than the support they provided to highly engaged students. And while all students regardless of engagement received approval for off-task behavior, low-motivated students received more approval for off-task behavior from their respective peer groups than high-motivated students did from theirs (Sage, Kindermann & Colvin, 1997).

Although the study of *networks* of peers originated in disciplines of sociology and anthropology this approach is increasingly being used in psychological research and is an approach that appears to show great promise for future research. One method of identifying networks of peers is Social Cognitive Mapping (Cairns, Perrin & Cairns, 1985)

The Social-Cognitive Map (SCM) Method

Identification of affiliations. The social-cognitive map (SCM) method of identifying peer affiliation (Cairns, Garipey, & Kindermann, 1991; Cairns, Perrin, & Cairns, 1985), is inspired by J. L. Moreno (1934), in which the students themselves identify individual children who are seen to ‘hang out’ with each other as being affiliated with a specific group. Individuals can be nominated to more than one group and

respondents are also requested to list themselves as group members when appropriate.

There are no restrictions on either the number of groups a child can list or the number of individuals listed within the group. Student respondents are also asked whether there are any children who do not belong to a group and these children are individually identified as isolates.

Several strengths have been identified by using SCM. Firstly the SCM method of identifying social networks does *not* use self-reports but rather, uses the *observations* of fellow peers. Thus SCM takes advantage of the fact that children are expert objective observers of each other and asks them to identify both the group and the children within each group. This type of expert child participant observer has a major advantage over other types of observers such as researcher, teacher or parent in that they have access to situations and settings that ‘outsiders’ might not.

This approach also means that ‘missing’ participants are still accounted for. For example in one study that included an overall population of 366 students, 280 students provided information accounting for 348 of the total number (Kindermann, 2007). In other words, 76% of the total number of students were able to *reliably* account for 95% of all known students. Using the alternative techniques previously described, ‘missing’ participants would not be available to self-nominate their group nor would they be considered as part of a dyad nominated by dyad partners. Put another way, SCM improves upon techniques of self-nomination by increasing participation rates above what they might otherwise have been and avoids problems of information-truncation that may be a limitation of other studies (e.g. Popp, Laursen, Kerr, Stattin, & Burk, 2008).

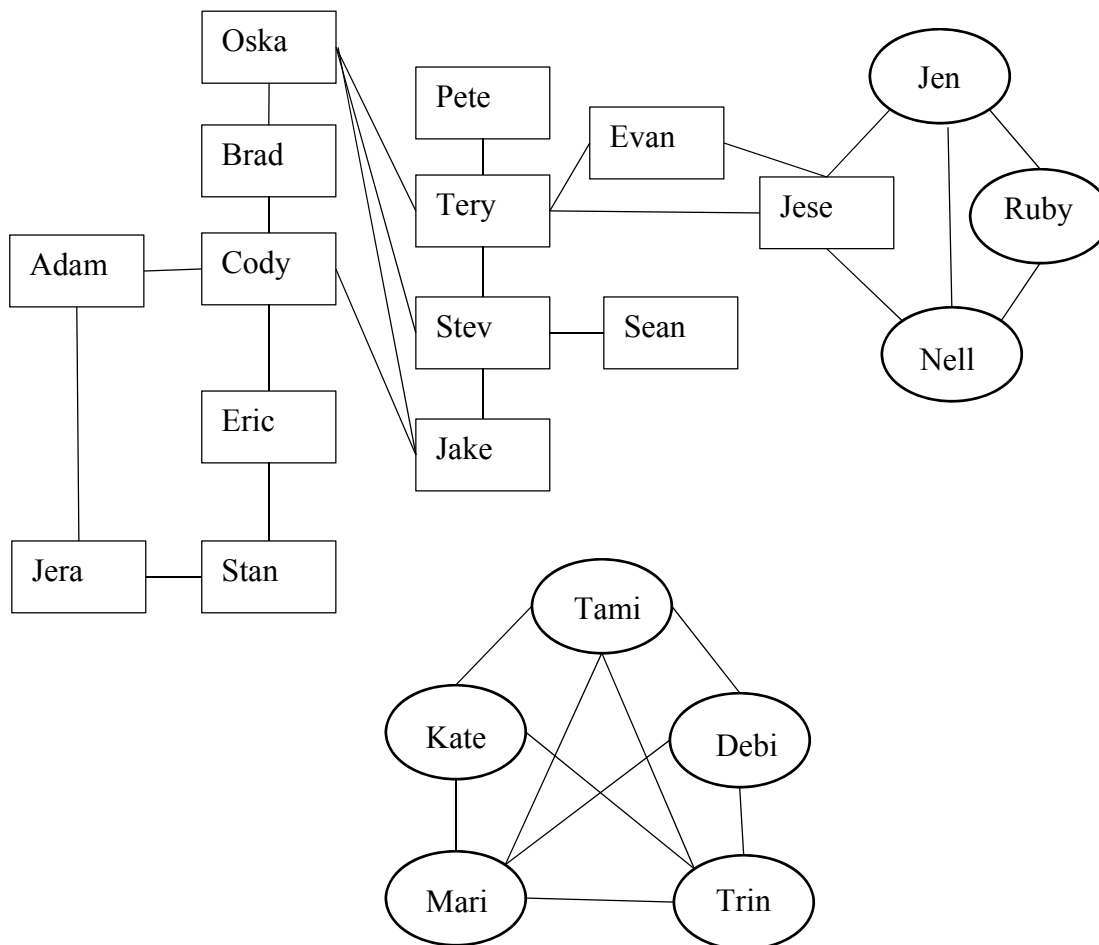
And importantly, by using observers' reports about *multiple* affiliations, *non-participants* can still be identified as members of the networks of study participants.

In terms of the reliability of network affiliation, prior research suggests that only slightly more than half the sample need nominate network members in order to provide a reliable Social-Cognitive Map (Cairns et al., 1985). Issues of individuals enhancing the scope of their own networks (Leung, 1996), are addressed because affiliations are only accepted if the likelihood of an individual child being nominated to the network, based on the number of peer observations, is greater than it would have been by chance alone. Previous research has shown that respondents tend to show relatively high levels of consensus in the groups they generate and tend to agree on those individuals who do not belong to a group (Cairns et al., 1985).

Nominations are next situated into a symmetric co-occurrence matrix whereby off-diagonal cells portray the frequencies with which children are nominated to be in the same group with other children. From this point some researchers have taken this information and applied algorithms to define as far as possible, clear non-overlapping groups (c.f. Kindermann & Gest, 2009). An alternative, and I believe, more realistic approach, is to identify groups uniquely for each person and thus preserve natural overlap. NETJAWS (Mehess & Kindermann, 2009) is a program developed by researchers at Portland State University that is specifically designed to provide information of individuals' connections with every other child and was used in the study proposed herein.

Assessment of group characteristics. It is important that any measures purporting to describe the characteristics of the group are obtained independently of the group members. This is because individuals' representation of others' characteristics are likely to be shaped by characteristics they hold themselves (Jaccard, Blanton, & Dodge, 2005). Once these measures have been attained, composite psychological profiles of each child's respective network of affiliations, based on the psychological attributes of importance to the researcher, can be established at the group level based on independent reports (considered to be more objective) at the individual level. The group level profile can then be used to examine the socializing influences exerted on the child him/herself as a consequence of the ongoing interactions, or proximal processes, between child and affiliates (it is important to note that interactions are reciprocal and, therefore, the child is also influencing his/her peer group. However, those influences are beyond the scope of this study). Prior research has found that children who are nominated to peer networks using the techniques thus documented interact with one another four times more often than with other same-sex classmates (Gest, Farmer, Cairns, & Xie, 2003). Grounded in Bronfenbrenner's (1998) ecological model, the proximal processes experienced within the microsystem of the peer network should, therefore, potentially generate observable development over the course of the academic year.

Figure 3: Peer Network Representation



Example of selected peer networks found across a 4th/5th grade sample of four classrooms (Sage, Hiller, Weaver, Newton-Curtis, Kindermann, 2002). Rectangles represent boys, ellipses represent girls. In this sample boys and girls tended to segregate by sex.

Figure 3 illustrates this approach by showing a graph representing selected peer groups found across a 4th/5th grade sample of four classrooms (Sage, Hiller, Weaver, Newton-Curtis, & Kindermann, 2002). Rectangles represent boys and ellipses represent girls. Lines between rectangles and ellipses represent linkages amongst students, in other words the network structure for individual students. The length of each line has no meaning but is there to show whether there is or is not a relationship. The positioning of rectangles and ellipses are for convenience of drawing only. The importance lies in which individuals are directly related to other individuals.

As can be seen from this representation, Tami provides the immediate peer socialization context for Debi's development together with Kate, Mari and Trin. Tami's development is however embedded within the immediate context of Kate, Debi, Mari. In other words while all 5 girls are linked the peer socializing context within which each is embedded is a little different and thus each child will experience their own specific socialization effects. Similarly, while Evan's immediate context for development is defined in his relationships, or linkages with Tery and Jesse, Jesse's context for development is defined by Evan, Tery, Emmi and Nell. Thus Evan's immediate developmental context is purely male, and Jesse's is comprised of both boys and girls. Further, despite the linkage between Jesse and Evan, this approach allows Jesse to be seen to be socialized by a larger peer network than Evan's.

Selection or Socialization

The issues of selection versus socialization are extremely important to consider when trying to understand the relative contributions of each to individual development

over time. Socialization is one process by which cultural and group norms, values and practices deemed important are instilled in the individual. For example, as parents we may be likely to reward the behaviors we like and hope to see repeated but punish those we dislike. Teachers may act similarly by giving smiles of encouragement when they see hard work or enthusiasm but issue a word of reprimand if homework fails to be turned in or lack of attention is demonstrated in class. The adults' hope is that these direct acts of socialization will shape the adolescent's behavior and values to conform to those that society approves.

However, when trying to examine whether there are socialization effects from the peer group to the individual, or the strength of those effects from the peer group toward the individual, the problem becomes a little more complex. Adolescents don't choose their parents. Adolescents can't usually control who their teachers will be but adolescents can choose the peers with whom they associate thus issues of 'selection' have to be confronted. This is because otherwise, outcomes could be attributed to socialization when in fact they are the result of selection processes.

While strong socialization influences have been found in classical social psychological research (e.g. Asch, 1955; Sherif, Harvey, White, Hood, & Sherif, 1961), these have been based on experimental designs where individuals were assigned to groups. The individuals that children interact with in *naturally* formed networks and who are influential in their development are self-selected, not experimentally assigned. Indeed, a defining feature of *naturally occurring peer groups* is self-selection (Kindermann & Gest, 2009). Importantly, there are reciprocal influences over time

between selection and socialization (note: processes of peer elimination are also occurring but are beyond the scope of this study), and one does not happen in isolation from the other. Thus, any association found between the child's peer network attributes and the child's own psychological attributes may indeed be due to socialization processes but equally, they may be the result of pre-existing conditions or concurrent factors, one of which could be processes of selection.

Adolescents choose their peer network members from their 'peer pool' based on a variety of features. Propinquity, or the general proximity of other peers, is one very important factor that is a foundation for peer selection. McPherson and colleagues (2001) suggest that propinquity creates contexts in which homophilus relations form. In early school grades these contexts based in propinquity may be restricted to those of the immediate classroom (and/or immediate neighborhood). However, the proportion of peers from other classes has been shown to increase in later grades as students become less classroom bound (Cairns et al., 1998). Thus it becomes even more important in examining the effects of adolescent peers on individuals that artificial boundaries, such as that of the classroom, are relaxed in order to establish where the *natural* boundary would fall.

In terms of peer group 'selection,' and as described in a recent paper by Kindermann & Gest (2009), a 'shopping model' (Patterson, Littman, & Bricker, 1967) was proposed during the 1960's whereby individuals would metaphorically 'shop' for peer affiliates that were deemed suitable in terms of desirable and/or compatible characteristics (within the constraints of propinquity, one assumes). This model continues

in importance in much of today's research (e.g. Dijkstra, Berger & Lindenberg, 2011; Dishion, Piehler & Myers, 2008; Logis, Gest & Ahn, 2012). Hartup (1996) suggested the importance of 'reputational salience.' A sociological review of the literature conducted by McPherson and colleagues (2001) suggests that "similarity breeds connection," (p. 415), that is, when given the opportunity, we like to be with and associate with similar others. This propensity to select affiliates based on similarity has been labeled homophily, and may be based on ascribed attributes such as race, age or sex, or on values such as religion, educational beliefs and so forth.

For the purposes of this study it is believed that there may be a high level of similarity, or homophily, in peers over a range of different characteristics and it is from this initial similarity, and the seeking of others with similar attributes, that peer networks may evolve. Consequently, similarity observed by the researcher within a group across individual members may be due to selection processes or may be due to the socialization processes exerted from the group toward the individual (of course, reciprocal influences from individuals to groups would also need to be considered). These processes are confounded.

Homophily and Selection

In the study of peer networks, homophily and selection are two closely entwined phenomena. In general terms, the homophily principle suggests that similarity breeds attraction and that contact amongst similar others tends to occur at a higher rate than contact amongst non-similar others (McPherson, Smith-Lovin, & Cook, 2001). In other words, similarity of affiliates and consequent psychosocial homogeneity of the resulting

network is not accidental in its formation but rather, arises as a result of deliberate *selection* on the part of the individuals who form the network itself. In consequence, effects of selection can be confused with those of socialization if measures are not taken to account for selection when trying to understand processes of socialization.

Similarity may be centered around certain characteristics, mutual liking for certain activities and/or behaviors but may also be determined by processes of selection. For example, from about age three children choose same-sex playmates when allowed to freely choose amongst children (Maccoby, 2002), and the majority of friendships during middle childhood tend to be same-sex (Schneider, 2000).

Kandel (1978) used Kendall's τ in order to assess similarity of affiliates before and after peer affiliations had occurred. The results suggested that the effects of selection were 'at least as powerful' as those of socialization on marijuana use and minor delinquency in a group of adolescents. Thus individuals chose to be with others who used marijuana and also influenced the degree to which marijuana was used.

In one small scale study of 64 seventh grade students and 43 tenth grade students (Zook & Repinski, 2002), researchers asked adolescents about selection preferences when choosing peer associates. Interviews were videotaped and coded by trained coders. More than one third of the participants said that peer similarity was important in the peers selected. Also mentioned were positive personality characteristics reflecting prosocial behaviors. Kupersmidt, DeRosier and Patterson (1995), investigated demographic, behavioral, academic and social similarities as predictors of friendship in 544 nine and ten year olds using logistic regression. Their research found that the more similarities

children had in terms of gender, race, socioeconomic status, aggression, withdrawn behavior and achievement, the greater the odds of being friends. Similarly, Logis and colleagues (2012) found that youth were almost one and a half times more likely to select same-gender as opposed to cross-gender friends in a study of fifth grade youth.

Other research also suggests that the similarity upon which selection is centered may be based on a wide range of dimensions. Urberg and colleagues (1998), conducted a comprehensive evaluation of friendship *selection* and its relationship with specific individual characteristics and values. Their longitudinal investigation consisted of over 1000 mixed race participants from sixth, seventh and tenth grade. Individuals were asked to nominate best friends, close friends and people they more loosely ‘hung out with’. Next, cigarette and alcohol use was individually assessed together with information regarding minor delinquent activities, preference for sensation seeking, sports activities, adult organized activities, social activities, and parent values. Researchers were then able to evaluate the similarity between individual adolescents and their stable friends, on the respective characteristics and values, and compare these results with those estimating similarity between adolescents and their ‘about to be friends’. The results of Pearson correlational analyses and multivariate analyses of variance provided evidence to suggest that adolescents selected affiliates based on all the above characteristics, degree of sensation seeking, sports activities, adult organized activities, social activities, and parent values. These characteristics were not independent and selection of one characteristic resulted in friends who were also similar on other characteristics (Urberg, Degirmencioglu, & Tolson, 1998).

The above researchers also wanted to establish whether selection on certain overt, easily observed, characteristics could result in similarity on less observable characteristics such as parent values and sensation seeking. Evidence was found for this too.

Although not directly applicable for this study, there is much evidence to suggest that deviance is one characteristic around which affiliations form. For example, Dishion, McCord and Poulin (1999) found that high risk youth are likely to formulate affiliations around deviant talk, particularly during adolescence. And in a longitudinal study of 902 adolescents aged 12 to 18, Popp and colleagues (2008), using structural equation modeling (SEM), found 'strong effects' for selection of friends who adhered to similar frequencies of intoxication as well as evidence for socialization of alcohol use.

As suggested in the previously described research, while socialization effects may occur as a result of peer affiliation, these have to be balanced against the similarity upon which the affiliation was initially made.

Mechanisms by which socialization is assumed to occur between children and their peer networks include contingent responses (Kindermann & Sage, 1999), persuasion amongst friends (Berndt, Laychak, & Park, 1990), group pressure to conform (Asch, 1955), modeling (Hall & Cairns, 1984), and through identity formation (Sherif et al., 1961). Much of the early work on socialization employed correlational techniques on cross-sectional data. When correlations were found, researchers attributed these to peer socialization influences (Ide et al., 1981). But correlations computed from cross-sectional data could result from one or both of the two processes: selection and/or socialization.

Consequently, if we want to see how one individual develops due to his/her affiliative membership, how can we disentangle the effects of socialization from selection? In reality, only longitudinal data can begin to solve this problem. Further, prior characteristics that are assumed to be those upon which selection is determined must be taken into account.

In sum peers have long been known to be important to a child's psychosocial development. However, historically much of the research into this aspect of development has been focused on social status within groups or children's friendships. While both approaches provide valid sources of information there are problems associated with each. An alternative method is to assess the effects of the dynamically changing peer group, the individual's peer network, on the individual over time. One that has major advantages over other approaches to capture the nature of these networks is one known as Social Cognitive Mapping. This method is beneficial in that it is based on publicly observable associations between children and is thus a more objective estimate of network affiliates. Further, reliability of reporting between observers can be directly computed and has been shown to be adequate when as few as just over half the full cohort of participants are available to nominate network affiliations.

Chapter 4: Third Variable Influences: The Case of Parents and Teachers

Adults are influential in children's lives. They are powerful in terms of their ability to structure their children's lives and their attempts at socialization are often deliberate and occur with forethought. Parents and teachers want certain things for and from their children and do their best to purposefully make this happen by structuring contexts and by attempting to alter behavior and emotions.

Parents also influence children's academic lives, directly as well as indirectly (cf. Bempechat & Shernoff, 2013). They influence which peers their children affiliate with (Brown et al., 1993; Ladd & Pettit, 2002) through practices such as monitoring where their child hangs out and with whom he/she associates; and by encouraging the youth towards certain activities such as advanced placement classes, sporting activities or volunteer work for example, thus assuring the individual is surrounded by the type of peer the parent is likely to approve. They also influence individual motivation. For example, Ginsburg & Bronstein found a positive relationship between parent encouragement and student motivation in a sample of 93 fifth grade students and a negative correlation between motivation and uninvolved parenting (Ginsberg & Bronstein, 1993). In a longitudinal study Gottfried, Fleming and Gottfried (1994) measured parental practices such as encouraging persistence, curiosity and mastery. Their research found that mothers' motivational practices were concurrently and longitudinally positively related to intrinsic motivation, similarly Pomerantz, Ng and Wang (2006) found mothers who used mastery oriented practices when helping their children with homework enhanced their children's mastery orientation and increased perceptions of

competence. Parental attachment was found to be positively related to preference for challenge in a sample of 135 sixth grade students (Wong, Wiest, & Cusick, 2002), and family responsiveness was associated with 'flow' in 165 students aged 14 and 15 (Rathunde, 1996). In sum, the research seems to suggest that warm, involved parenting has a positive effect on academic motivation.

It is also possible that children select others to associate with whose parents are similar on one or several attributes (Urberg et al., 1998). For example Dishion and colleagues (1991) found that peers who experienced low levels of parental monitoring tended to select others with similarly low levels of monitoring. It may thus be that instead of, or in addition to socialization of later peer deviancy by processes such as 'deviancy training,' the third variable of low parental monitoring may be a contributor to deviancy.

Fletcher, Darling, Dornbusch and Steinberg (1995), examined relationships between social networks, peer affiliates' parental authoritativeness and delinquency and substance use in 14 to 18 year olds. These researchers found that the *general* level of authoritative parenting in the peer *network* was positively related to a range of outcomes including grade point average, homework completion, bonding to teachers, school orientation, and academic competence and negatively related to school misconduct, drug and alcohol use and delinquency even after controlling for the adolescent's own parents' parenting style. It may be that peers who have similar experiences at home choose to associate with each other and consequently these parents are socializing their children similarly. Thus it is possible that parents are similarly contributing to the development of

engagement. Indeed, Brown, Mounts, Lamborn and Steinberg (1993), found evidence to suggest that parenting practices such as monitoring and encouraging achievement were significantly positively related to adolescent academic achievement, sense of self-reliance and negatively related to drug use. This in turn was related to peer group affiliation.

In regard to teachers, Wentzel (1997), found in a study of 375 8th grade students that students' academic motivation was positively correlated with their perceptions of the degree to which teachers cared about them even when controlling for previous academic performance and perceived control. Further, Ryan and colleagues (1994), found a positive relationship between teacher/student relatedness and academic engagement in a group of 606 seventh and eighth grade students, and in a longitudinal study examining the effects of 1,046 students' perceptions of their school environment in 7th grade, on engagement and achievement in 8th grade, teachers' social support was found to positively affect later engagement whereas teachers' foci on performance was found to be negatively associated with later engagement (Wang & Holcombe, 2010).

Other research has found perceptions of teacher support to be related to achievement expectancies, values, motivation and performance (Goodenow, 1993; Murdock, 1999).

Skinner and Belmont (1993) found that students who were more highly engaged were more likely to experience teacher support and thus increase their level of engagement. Conversely those students who were disaffected experienced their interactions with teachers in a negative light and tended to decrease in their levels of engagement. And more recent research by Skinner and colleagues has found that teacher

support contributes to changes in engagement through influencing students' perceptions of themselves as autonomous, competent and feelings of connectedness to their teacher (Skinner et al., 2008).

If it is likely that similar children tend to hang out together, then it would seem a next logical step to assume that teachers are likely to provide children and their affiliates with a similar quality of support. Thus again, rather than peer socialization of engagement the development we see may be due to teachers interacting with similar peers, similarly.

The preceding findings suggest that the quality of the parent/child relationship and the quality of the teacher/student relationship is linked to both the selection of peers as well as to individual motivation and so cannot be ignored when attempting to examine the contribution of the peer network to educational development. As previously described, children are likely to hang out with others who are similar on a variety of attributes, one of which may be educational characteristics. This is because for any student, it is simply helpful to be affiliated with age-mates who can help with academic tasks, and educational settings may be set up in a way that encourages students to work in groups. Consequently, it is possible that teachers may treat students similarly who have affiliates with similar others.

This could be true for parents too. It may be that children who are highly motivated tend to hang out together but they may also have, as a common socializing agent, parents that similarly engage with them in academic activities in the home (Newton-Curtis, 2006). In other words, what appears to be peer group influences could in

reality be attributed to the fact that peer-group members have been exposed to similar external experiences from teachers, parents or both. Thus in studies that seek to disentangle the influences of socialization from selection, controls would be necessary in order to account for these influences.

Chapter 5: The Peer Group as a Dynamic Developmental Context

“If you are in a reinforcing feedback system, you may be blind to how small actions can grow into large consequences – for better or for worse”

(Senge, 1990: p. 80).

The Contribution of a Systems Perspective to Understanding the Peer Network and its Influence on the Individual

A goal of systems theory is to produce an overarching set of principles that can be used by researchers and thinkers from multiple disciplines to understand and explore a wide range of phenomena. It can be used as a tool to understand interconnections and interdependencies that are different in terms of time and space, but have similar patterns. Because of this, systems concepts are useful when thinking about the functions, structure and dynamics of the peer group as it relates to the individual, and as the individual relates to the peer group. In this context, the peer group might be considered to be at the unit level, while individuals within the peer group would be sub-units of the unit (Lendaris, 1986).

Peer network dynamics. Children’s peer groups tend to be naturally occurring, and may emerge as a consequence of features such as similarity in characteristics, liking or disliking certain activities or social endeavors, or even affiliation for or dislike of other people.

The peer group itself is a complex, open, self-organizing system. To Bronfenbrenner (2000), the reciprocal interactions that occur between individuals or

objects within a developing person's immediate context (microsystem) are the 'engines of development'. These interactions are core to each individual's development.

Bronfenbrenner refers to these as proximal processes; they happen on a regular basis and become increasingly more complex as time goes on and development proceeds. Proximal processes may optimize or undermine normative development, but the degree to which they are likely to influence each person is moderated by the individual's own characteristics – or attributes. It should be noted that proximal processes are bi-directional implying feedback between actors involved in the interactions. By implication proximal processes will influence development at two levels, impacting both the development of individuals' attributes and those of the peer group.

As an open system, the boundaries of the peer group are permeable – some groups will have greater or lesser permeability than others and this may depend on the group structure. Entropy, peer network breakdown, is ameliorated by peers actively seeking to join the network and the individual child actively selecting-in new members (as others leave or are eliminated); some peers within the network will remain stable; nonetheless boundaries are fuzzy in that networks overlap - and although individuals may be embedded in one peer network they may move in and out of other groups too.

In line with the notion of a changing and developing peer group, Moreno's (1934) classic work on sociometry also saw the 'social group' as one that was dynamic, with forces that change over time such that the experience of the individual within the group would consequently also change (cf. Bagwell et al., 1998). And if experiences change then we can assume that development occurs as a consequence of the changing

environment. Aligned with the notion that forces change over time, the peer system maintains flexibility in both its structure and function. Group members maintain distinct roles within the group; nonetheless some roles may change as new members join or are eliminated. And as the composition of the peer group changes so too may the structure of the group gradually transform, for example the size of the network or the degree to which entry is allowed based on a person's sex.

In terms of engagement, previous research has suggested that despite peer turnover there is a tendency toward dynamic equilibrium; in other words network engagement is likely to remain relatively stable (Kindermann, 1993; 2007). The system seeks homeostasis at both the individual and group level and selection of new group members is based on features salient to the selector and that serve to maintain equilibrium of the group; goal seeking behavior is exhibited tending toward balancing the effects that peer turnover might otherwise have on changes in individual and group level attributes (Sage & Kindermann, 1999); nonetheless, self-reorganization or development to higher levels of complexity allows the system to adapt to external forces. Elimination of peer members may occur as a result of incompatibility between the eliminated person and the system and elimination may be propelled by the individual deciding to leave the system or by the system deliberately expelling the individual.

Top down influences from the peer network may have a developmental or a 'transformational' effect on the individual. Inputs, as well as being in terms of new peers entering the peer system, also take place at the level of the individual child from peers, parents and teachers in terms of values, expectations, demands and warmth of bi-

directional relationships, these contributing to the ‘transformational processes’ of the child as well as the child’s selection of peers, and selection into peer networks.

The importance of time. Inherent in the notion of a dynamic system is movement within the system, and in time and space. Microtime describes the minute by minute continuities and discontinuities that occur within the proximal processes driving development; mesotime describes longer periods of time over which development occurs in weeks or months or even years, while macrotime speaks to the development that occurs across decades or even generations (Bronfenbrenner, 2000).

Feedback into the peer system occurs by way of the child, such that child-level attributes emerging over microtime may contribute to peer type *selection* over mesotime time, also impacting the *type* of peer trying to select into the network, and thus influencing the quality of socialization taking place. Feedback also occurs from the peer system to the child such that individual development occurs. Not all feedback loops are equal in force, further some may gain or lose in strength as time progresses. Feedback occurs from different directions and can be reinforcing or counterbalancing. The multitude of reinforcing and counterbalancing loops within the peer group, in association with those of parents and teachers increases the complexity of the individual’s development across time. For example, a reinforcing vicious cycle could develop between a child and a parent whereby coercive parenting leads to a drop in academic engagement which then increases the coerciveness of the parenting leading to further declines in child-engagement (cf. Newton-Curtis, 2006). However, the child’s teacher may have a counterbalancing effect such that when s/he sees the drop in engagement s/he

increases warm supportiveness of the student thus counteracting the effect of the home environment (microsystem).

Through these multitude of processes it would be expected that engagement (the focal attribute of interest for this study) occurs as an emergent attribute at two levels, that of the individual and that of the network and in multiple time frames. Minute to minute and day to day, microtime processes contribute to change across months and years in mesotime, in other words, from academic term-to-term leading to year-to-year.

Levels, context and attributes. Also contributing to a systems understanding of the peer group and individual is the notion of levels, context and attributes.

Bronfenbrenner in his bio-ecological model posits that an individual develops within four related, nested contexts, or environments – similar to the nestedness of Russian dolls (it is important to remember that Bronfenbrenner’s bio-ecological model also includes the interacting notions of time, proximal processes and person characteristics – described below - adding a dynamic element). Similar to open systems theory he suggests that boundaries between these systems are permeable and that information can flow from one system to another, thus causing change to both proximal and more distal systems; the systems interact with one another having direct and indirect effects on the person’s individual development through these interactions. Bronfenbrenner referred to these systems, or contexts as the microsystem, mesosystem, exosystem and macrosystem. A description of each is provided below:

Microsystem. A child’s development takes place within context, the most immediate of which is the microsystem. The microsystem includes the day-to-day

immediate contexts in which the child is embedded and the dyadic interactions within the microsystems of parent-child, teacher-child and peer-to-peer. Other microsystems could include that of the child and neighbor, the child and church pastor and so forth. These microsystems have a direct impact on development.

Mesosystem. Individuals develop within multiple microsystems. The mesosystem reflects the interconnections of the different microsystems the person moves between – in other words, it is a system of the microsystems and can be considered another level of the system. The mesosystem (system of microsystems), will influence the individual in ways that may have additive, interactive, enhancing, buffering or ameliorating effects on the impact of other microsystems on the person's development depending on the force and direction of feedback within and between systems. Traditionally, research has tended to focus on the influence of single microsystems when considering child development but in order to gain a more nuanced perspective multiple microsystems should be simultaneously explored. For example, it might be that a child who is neglected in the home microsystem is buffered to some degree from the ill effects this could have on development by a teacher who provides warm support within the classroom microsystem. Following on from this, in order to study the effects of the peer network on a child it would also be important to account for parent and teacher contexts as these three microsystems are typically seen as the major microsystems in a child's academic development.

Exosystem. The exosystem refers to the linkages between systems that influences the development of the individual, but in which the individual is not directly located. For

example, one study found that a fathers' stress at work impacted their interactions with their children at home in a way that as work-stress increased, fathers became less behaviorally and emotionally engaged with their children. Over time a father's negative work climate was associated with parent-child interactions that were more negative and less positive in tone (Repetti, 1994). The child is not embedded within the father's work microsystem but is indirectly affected by that context. By considering exosystem influences further understanding can be added regarding the complexity in which development occurs.

Macrosystem. The most global of the systems in which the person is embedded is the macrosystem and includes components such as the overarching cultural mores – dominant beliefs, political institutions, economic environment. For example, it could include government policies that require children to be provided with healthcare – or not, or those that require children to be enrolled in an educational system – or not. But, an attention to the macrosystem helps us to consider the differences in global environments that children might experience. For example, children of middle class parents might be more likely to live in relatively safe neighborhoods, have easy access to parks and well-funded museums, go to schools where resources such as current textbooks and new computers are readily available, and have teachers who are well-qualified. On the other hand, children within impoverished communities may live in environments quite different – neighborhoods may be unsafe, schools may be rundown with resources that are out-of-date or totally lacking – extra curricula activities may not exist, there may be no parks or museums within easy access. Culture also plays a role, for example in some

countries it is important to educate boys but not girls – girls may even be prohibited from being educated. Thus the macrosystem is also important to consider when exploring the development of an individual.

Levels. Lendaris (1986) also talks about the importance of considering the environment although Lendaris' focus is more attuned to levels of the system; nonetheless, Bronfenbrenner's notion of embeddedness is inherent in Lendaris' description of levels. Lendaris' conceptualization is useful in that the emphasis is placed on understanding the importance of determining the relevant environment dependent upon the research question at hand and the multiple perspectives that should be taken. According to Lendaris, at the A level the system is the 'whole', while the B level contains the sub-units of the system. And all lay within the supra-system or environment in which the unit exists. From this perspective the unit of importance in this study might be considered to be the peer group. The B level is comprised of the individuals within the unit and the supra-system or relevant environment could be considered as the town. Nonetheless, to understand the system to its fullest one should move up a level from the immediate system and then down a level taking 'multiple perspectives.'

In changing perspectives to move up one level, the town would now be the A unit with peer groups as the B level, as sub-units of the town – the state might be considered as the supra-system. However, for this study it makes more sense to move down a level rather than up. If we move down one level the unit would be the individual, the supra-system would become the peer group. Of interest would be the sub-units of the

individual. From Bronfenbrenner's perspective these sub-units could be considered to be the person characteristics.

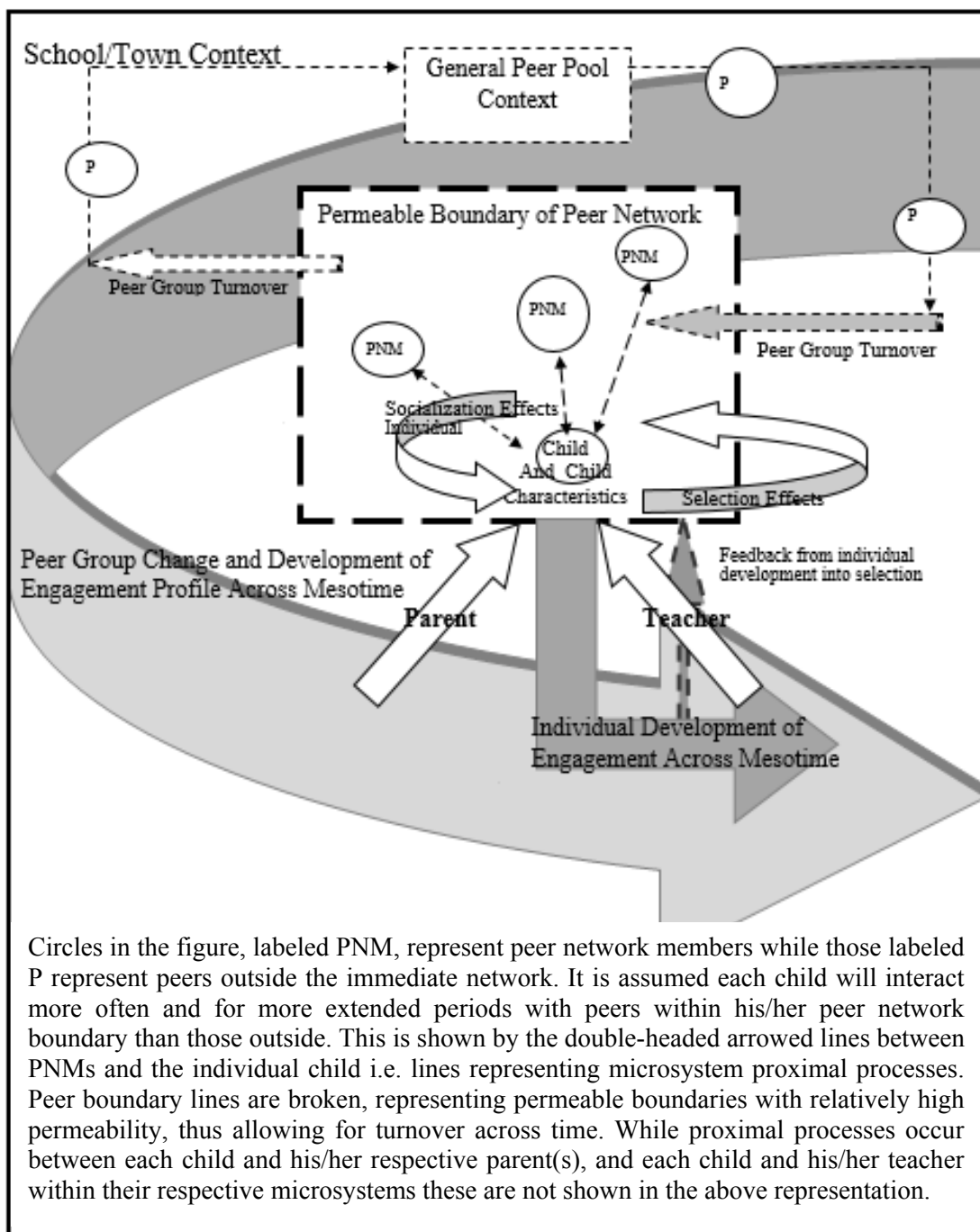
Person characteristics. According to Bronfenbrenner three types of within-person characteristics are important to consider: force, demand and resource. Force characteristics refer to those features of the individual that promote or impede the probability of proximal processes; for example, the person's sociability or perhaps their level of attractiveness might make it more or less likely for others to want to interact or sustain interactions with them. Resource characteristics are the bio-psychological aspects of the individual such as their intelligence, gender, culture, abilities and skills that serve to allow for the increasing complexity of the proximal processes within the microsystem. And lastly, demand characteristics refer to features of the person such as their temperament that will evoke reactions from the environment. These three within-person characteristic-types will synergistically work to sustain or undermine the frequency, concentration, extent, quality and timing of the proximal processes with others. Individual person features will evoke differing proximal process from peers, parents and teachers. Of course, the extent and quality of those interactions will also be a function of the person characteristics of the interaction partner, or other sub-unit(s).

A synthesis of these two formulations, that of Bronfenbrenner and Lendaris, brings attention to different layers that should be considered, helping the researcher to focus on the phenomenon of interest while being mindful of the embedded nature of the individual within context.

Within the current study the major emphasis is placed on understanding the individual embedded within his/her peer network microsystem, and the peer group influence on the emergent attributes of the individual – that of academic engagement, while paying attention to the structure of the students’ respective peer microsystems as well as the parent and teacher microsystems – all of which overlap to provide the mesosystem context for the individual’s development.

Based on insights taken from systems concepts and Bronfenbrenner’s bio-ecological model, Figure 4 provides a pictorial representation of the potential dynamics of the peer network system, embedded within the general peer-pool context, itself embedded within the school and town context, from the “perceptual stance” (Lendaris, 1986), of the individual child. The representation illuminates the changing interactions between the person, the processes of socialization and selection, the interactive interpersonal proximal processes within context and time (Bronfenbrenner & Morris, 1998).

Figure 4: Context of Development



Circles in the figure, labeled PNM, represent peer network members while those labeled P represent peers outside the immediate network. It is assumed each child will interact more often and for more extended periods with peers within his/her peer network boundary than those outside. This is shown by the double-headed arrowed lines between PNMs and the individual child i.e. lines representing microsystem proximal processes. Peer boundary lines are broken, representing permeable boundaries with relatively high permeability, thus allowing for turnover across time. While proximal processes occur between each child and his/her respective parent(s), and each child and his/her teacher within their respective microsystems these are not shown in the above representation.

Chapter 6: Goals of the Study

The major goal of this study is to understand the influence of peer network socialization on individual academic development, as seen in quality of engagement over time, while accounting for the effects of peer selection and assortiveness in a cohort of seventh grade students.

The key variable in this study is that of student classroom engagement as rated by teachers. This is because, as previously described, students are apt to project attributes they hold regarding the self onto others whereas teachers may be more likely to provide a more unbiased view of student engagement.

The engagement construct has behavioral and emotional components and has been shown to be easily observable by those around. For the major questions (1 and 2), this construct was measured twice, once in Fall of seventh grade and once in the Spring. It is also from this measure that peer profile measures of engagement were computed for each participating child.

Two other key variables are those of student reported teacher involvement and student reported parental involvement. Both measures were taken in the Fall of seventh grade. The teacher involvement construct measures the degree to which the student feels warmly supported by his or her teacher. The parent involvement construct is a four-item scale measuring parental attunement with the student and their activities. The parent and teacher measures were important to consider since it was theorized that what appears to be peer group influences could in reality be attributed to the fact that peer-group members were exposed to similar external experiences from teachers, parents or both. Parent and

teacher contexts have both been identified in previous studies as important to promoting academic outcomes (Skinner & Belmont, 1993; Skinner, Johnson & Snyder, 1995), specifically engagement and were therefore are important to consider.

As described previously, part of the issue in designing studies of peer group socialization influences on individuals has been how to weigh processes of selection against those of socialization. One method in which this may be done is to include control variables for network and individual characteristics upon which selection is made. In terms of network characteristics, it was decided that the structure of the network could be a feature upon which students are likely to select; hence, dependent upon preliminary analyses it was expected that controls would be placed into the major models to adjust for this such as, for example, the percentage of children of the same sex within each network, Fall network size, Fall absolute difference scores in engagement between the individual and group, percent of peer network in the same homeroom, and finally group stability from Fall to Spring. Individual characteristics upon which selection was expected to be made included cognitive ability, the proxy for which was a measure of mathematics and language arts achievement collected in the Spring of sixth grade and Fall of seventh grade, and lastly the adolescent's sex.

Initial Questions and Expectations

Before analyses are undertaken to assess the effects of peer network socialization effects on students' engagement a series of preliminary analyses need to be conducted to understand the engagement characteristics of individual students. The goal is to understand whether the results obtained in similar research focused on sixth grade

students can be upheld in seventh grade. A further set of preliminary questions are then posed to understand the characteristics of the peer networks and the intersection with students' individual engagement.

Preliminary questions: student characteristics. The following section gives an overview of the questions to be addressed together with the overarching reasons for their exploration and expected results as an outcome of those explorations.

Question 1. What are the engagement characteristics of seventh grade students, are parent and teacher characteristics associated with engagement, and how does this differ between males and females?

Question 1.1. How engaged are students and how stable is their engagement from Fall to Spring?

Before attempting to investigate the effects of peer socialization on engagement it is important to understand how stable the construct of engagement is and to assess whether there are ceiling or floor effects in the data. Engagement has generally been shown to be relatively high on the four point engagement scale and to remain highly stable in fourth/fifth grade when assessing quality of engagement from Fall to Spring (Sage, Hillier, Weaver, Newton-Curtis & Kindermann, 2002) and from Fall to Spring across 6th grade (Kindermann, 2007), therefore similar levels engagement and of stability were expected across 7th grade.

Expectation 1.1. Engagement as an overall construct and when broken down into its constituent constructs of emotional and behavioral engagement is expected remain highly stable from Fall to Spring.

Question 1.2. Are girls more engaged than boys, does engagement change over time and does engagement change differently depending on sex?

There has been some evidence to suggest that girls were more engaged overall in this sample of children during sixth grade (Kindermann, 2007), this may continue to hold in seventh grade. If this is the case then this could make a difference to the direction to which girls versus boys socialize and/or are socialized by other peers and so is important to assess and include as a control variable in the major models.

Expectation 1.2. It is expected that girls may be likely to be more engaged overall than boys, but that the degree of engagement may decline across the academic year for both sexes.

Question 1.3. Are there differences in terms of engagement for participants versus non-participants.

If differences are found between participants and non-participants in terms of engagement this may threaten the generalizability of the study therefore it is important to assess this at the start. If the percentage of non-participants is large and if large differences were to be found between participants and non-participants it could be necessary to analyze this sub-group independently.

Expectation 1.3. Based on Kindermann (2007) no differences were expected in terms of engagement between participants and non-participants in the cohort of seventh grade students.

Question 1.4. Is there a difference between those who are identified as having a network and those with no networks in terms of their level of engagement?

It is important to understand how many students are without a network nomination and to understand where they fall in the overall scheme of the cohort in terms of their engagement. If it were found that they are significantly lower in engagement than their peers who have networks then the extant research shows that this group of children could be at increased risk for school failure, and future study and intervention could be especially important. While it will not be known whether children without networks have been actively ‘rejected,’ as previously described, rejected aggressive children have been shown to do more poorly in school.

Expectation 1.4. It is expected that a minority of students will fail to be nominated to a network, and that they may have lower rankings of engagement when compared to the rest of their cohort.

Question 1.5. Is cognitive ability associated with engagement?

While it is not hypothesized that *all* children who do well in school are highly engaged previous research has shown small to moderate correlations between the two (e.g. Newton-Curtis, 2006). Thus again, this is a variable that should be accounted for when assessing peer socialization effects if correlates are found. As a proxy for cognitive ability mathematics and language arts achievement scores were used.

Expectation 1.5. A positive association between cognitive ability and engagement is expected.

Question 1.6. How involved do students perceive their parents and teachers to be and is this concurrently related to individual engagement?

There have been multiple studies that suggest the importance of warm involvement from both parents and teachers when considering the development of children's academic engagement (e.g. Skinner & Belmont, 1993; Newton-Curtis, 2006). If it is shown in this sample that parents' and teachers' involvement is related to engagement it is possible that any change seen in students' individual engagement over time could be due to parents or teacher socialization effects and not socialization from peer networks. Thus this is an important relationship to investigate.

Expectation 1.6. It is expected that parents and teachers will be highly involved in students' lives and that involvement will be positively related to concurrent individual engagement.

Preliminary questions: networks. If we are to assess the effects of peer network socialization on individual students it is first important to understand the percentage of students who have been nominated to a network as well as the structure and characteristics of networks themselves. Therefore a series of preliminary analyses are undertaken. These are described in the next section.

Question 2. Is SCM a method that can allow for all, or nearly all, possible children within the population of interest to be accounted for when social networks have been created?

Optimizing the number of participants in a study is extremely important for the reduction of biased results as well as for significant effects to be demonstrated. As

previously described, some studies have provided evidence to suggest that SCM can reliably increase the number of children identified as network members by as much as 10% thus providing the opportunity for a far richer interpretation of the network and structural changes in the network over time.

Expectation 2. It is expected that SCM will allow for the majority of children within seventh grade to be identified as part of the network regardless of whether the child was present on the day networks were measured.

Preliminary Questions: Network Characteristics and Their Relationship to Engagement.

Question 3. What are the characteristics of peer networks and how are these characteristics related to engagement? Additionally, are structural characteristics of the peer network associated with motivation? Once again, if structural characteristics of networks are shown to be related to engagement, this could be a result of individual selection and would be important to account for when assessing network socialization effects on individual engagement. Without taking this into account effects that appear to be from peer network socialization could in fact be a result of selection processes.

Question 3.1. To what extent are group profiles of engagement from Fall to Spring shown to be stable. When overall engagement is decomposed into group profiles of behavioral engagement and emotional engagement does the strength of stability remain the same?

Once again, previous work has demonstrated group profiles of engagement to remain relatively stable across fourth/fifth grade (Sage, Hillier, Weaver, Newton-Curtis & Kindermann, 2002), thus similar expectations are held for seventh grade students.

Expectation 3.1. Group profiles of engagement as an overall construct, and when broken down into its constituent constructs of emotional and behavioral engagement is expected to remain highly stable from Fall to Spring.

Question 3.2. Are peer groups motivationally homogenous? Further, is there motivational homogeneity between networks and individuals when the engagement construct is broken down into the subcomponents of emotional and behavioral engagement?

Motivational homogeneity is important to assess because it is indicative of selection effects. Based on selection principles of homophily, or the propensity of individuals to select to affiliate with others who are similar on attributes of relevance or importance, it is expected that group homogeneity around motivation will occur as a consequence of other criteria, not all of which are necessarily associated with schoolwork. Kindermann (2007), found that regardless of network size children tended to differ less than 1 standard deviation from the overall engagement profile score of their group.

Expectations 3.2. There will be a positive correlation between individual motivation and the individuals' group profile scores for motivation.

Question 3.3. Is network stability and network size related to engagement?

If more stable networks are related to engagement it will be necessary to account for this so that differential amounts of exposure to children within networks (dosage) can be controlled when assessing socialization effects of the network on individuals. It is possible that size of network is also related to engagement. Popularity was not assessed in this study, nonetheless it is possible that popular children have larger social networks than less popular, and prior research has shown popularity to be positively correlated with school success.

Expectation 3.3. Network stability is expected to be related to engagement with higher stability related to higher engagement. Similarly, it is expected that network size will be positively related to engagement.

Question 3.4: Do mean differences exist between homerooms on ratings of engagement?

In the world of schools there are tough teachers and easy ones. Some grade easily and others are more stringent. Students are tracked or may be non-randomly placed within certain homerooms because of a teachers' skill with a certain type of student. These real world issues may cause some bias across homerooms and if so, should be accounted for. It is important to note however that while engagement was assessed by homeroom teachers the *peer* influences are not necessarily homeroom based because students move individually from classroom to classroom dependent upon specific subject lessons.

Expectation 3.4. It is expected that due to everyday differences in things such as teacher expectations and so forth that there is likely to be a difference in mean levels of engagement across homerooms.

Major Hypotheses and Questions

Major question 1. Can Fall peer group engagement profiles predict Spring individual engagement in a cohort of seventh grade students when controls are used for assortiveness variables?

Previous work has shown that changes in raw levels of engagement of around 2% have been indicated when assessing the effects of peers on the individual (Kindermann, 2007). While these changes may be small they are important because across time they may add up to a large cumulative difference in inter- and intraindividual levels of engagement. It is possible that these changes may increase across seventh grade as adolescent influences become stronger.

One of the major questions to be answered is whether or not peer socialization effects can be found when variables that are expected to account for a major part of the variance in individual engagement are controlled. While some studies have attempted to simultaneously assess the contribution of peers, teachers and parents to academic development none, with the exception of Kindermann (2007), have done so by a) using SCM and b) while attempting to control for selection effects. The current study is the first to do so in a cohort of seventh grade children.

It is expected, that based on preliminary analyses, variables to be controlled may include individuals' sex, network size, cognitive ability (mathematics scores and

language arts achievement), group stability, homogeneity of network gender, homogeneity of network engagement, parent and teacher involvement and homogeneity of network homeroom.

Hypothesis 1. Assortiveness variables will contribute to the variance in Spring levels of individual engagement but there will be evidence of significant peer network effects on individual Spring engagement over and above the control variables.

Major question 2. Do Fall peer group engagement profiles remain significant when assortiveness variables are controlled *and* when controlling for the students own level of engagement in the Fall?

Socialization effects are indicated by people developing over time. If evidence can be provided to suggest that there is development in individual engagement from Fall to Spring then it is necessary to understand if what we are seeing is *socialization* of engagement over time. In order to do this it is necessary to control for the individual's own level of engagement in Fall.

Hypothesis 2. When controlling for the individual's own level of engagement in Fall together with the assortiveness variables the peer effects will be reduced but remain significant. Thus small but significant socialization effects are hypothesized.

Chapter 7: Method

This study focused on a cohort of seventh graders in a rural/suburban town in a northeastern US state and represents a replication of previous work investigating the effects of peer socialization on students' academic engagement of the same cohort of students when they were in sixth grade (Kindermann, 2007). To date it is unknown whether peer influence on academic engagement is still significantly evident during seventh grade.

These data were originally collected as part of a larger longitudinal study (Skinner, Johnson, & Snyder, 2005). There were approximately 25,000 people within the town, most of whom (90%) were of European American descent. Most (87%) held a minimum of a high school diploma. There was only one public school within the town catering to seventh graders and while some students of this age group, living in the town, may have commuted to the next town which was 16 miles away or gone to private school it is estimated that this number was relatively small.

Setting and Participants

Participants consisted of 343 seventh grade students; fifty-two percent male (N = 178) and forty-eight percent female (N = 165). No information was requested regarding racial background or ethnicity for the students themselves. Administratively, each youth within the school was assigned a homeroom. Homeroom teachers saw students on a daily basis and were the ones to take principal responsibility for each student and the ones that knew each student the best. There were 15 homerooms in all, each with their own

homeroom teacher – each homeroom teacher answered surveys for students within their own homeroom.

Procedure

Questionnaires were distributed to teachers and students twice during the school year, once in early Fall and again in May. In each case there was a one month window around which the assessments were distributed and data were collected in order that all participants had an opportunity to complete the measures. Students completed their measures during regular school hours but teachers completed theirs during their free time.

Measures

Academic engagement. Student engagement was measured with a 14-item 4-point scale designed to assess *teacher perceptions* of student behavioral and emotional engagement (Wellborn, 1991). Teachers were asked to rate each student within their homeroom using items such as “In my class, this student works as hard as he/she can”; “In my class, this student appears happy”). Teacher ratings were used for analyses rather than the ratings of fellow peers firstly because they knew the students well and secondly because studies have suggested that peers tend to project their own values onto those of their peers (Schneider, 2000); thus, teachers were considered more objective observers than peers.

Following a model proposed by Wellborn’s (1991) concept of engaged versus disaffected actions and emotions the measure is comprised of two sub-constructs: behavioral and emotional engagement. Behavioral engagement with academic endeavors is captured by positively worded items suggesting behaviors such as effortful attention,

and focus. It is also captured by negatively worded items suggesting behaviors such as apathy or inattentiveness. The scores for the negatively worded items are then reversed coded and aggregated with the positively worded items to form the behavioral engagement sub-construct. The sub-construct of emotional engagement is captured and computed in an identical fashion. Items reflecting engaged emotions such as interest and enjoyment are aggregated with reverse coded items that reflect emotions such as anxiety and anger. The two sub-components are then combined to form an overall measure of academic engagement. Sub-components of this conceptualization of engagement have previously been used independently and in an combined fashion (e.g., Newton-Curtis, 2006).

Previous studies have provided evidence to suggest that the components of engagement are internally consistent ($\alpha = .95$, $N = 185$; Wellborn, 1991), stable over time ($r = .73$, $p < .01$, $N = 144$) moderately inter-correlated ($r = .31$, $N = 144$), and moderately correlated with school grades and standardized tests ($r = .40$ for math; $r = .58$ for reading; (Skinner & Belmont, 1993; Skinner, Kindermann, & Furrer, 2009). Teachers completed surveys for approximately 312 students in the Fall of seventh grade and for 165 seventh grade students the following Spring. One hundred and fifty-eight students were assessed in both Fall and Spring.

Academic achievement. Information regarding student grades was accessed in Spring of sixth grade and Fall of seventh grade in mathematics and language arts. All letter grades, including those for effort within subject were converted to numbers and

then averaged to provide a score for each child (F through A including minuses and plusses were converted to numbers 0 through 12 respectively).

Teacher involvement. Student reports of teacher involvement were completed in the Fall by students using an 8-item measure with a 4-point scale. Students were asked to think of the teacher that knew them the best and then answer items such as “I wish my teacher knew me better,” and “When I’m with my teacher I feel ignored.” Negatively worded items are reverse coded and all items were aggregated to form an overall measure of teacher involvement. Previous studies suggest that the measure is internally consistent ($\alpha =$ between .79 to .85 for students in third through seventh grade) and moderately correlated with student engagement, ($r =$ between .24 to .33 for students in third through seventh grade; Skinner, Zimmer-Gembeck & Connell, 1998). In all 312 student reports of teacher involvement were received.

Parent involvement. Student reports of parent involvement were completed in the Fall using a 4-item, scale measuring degree of parental warmth with the student. Students responded to items such as “My parents understand me well,” and “My parents know a lot about what goes on for me,” on a 4-point scale. The Parent Involvement items have been previously shown to be internally consistent ($\alpha = .88$), and to be correlated with student self-reports of academic competence (Skinner, Johnson & Snyder, 2005). Three hundred and six students provided information on their parents’ involvement.

Peer groups. Youth were provided with questionnaires in which they were asked to list the names of different youth within their grade that would frequently ‘hang out together.’ This was done from free recall. They were told that there was no restriction on

the size of the groups and that they should try to list as many people that they could think of within each group but also that groups as small as dyads should be included. They were also asked to identify children with no group. Students were instructed to include themselves in one or more groups as appropriate and that it was 'ok' to include the same individual in multiple groups. Researchers provided room for students to list up to 20 groups with 20 members within each group. None of the students exhausted the resources provided. The information garnered from the group nominations was used to construct peer networks.

The number of children who provided information about peer networks at the beginning and end of seventh grade was assessed. Based on the number who provided information during sixth grade it was estimated that more than 250 students would provide information; however, in the Fall of 7th grade only 198 (58%) children provided useable peer network information. Fifty-six percent of the respondents who provided useable information were female. Fifteen reports were unusable because the entries were illegible or the student had only provided first names and/or nicknames; nonetheless, the sample size was still considered sufficient to account for the majority of children in the cohort; previous research has shown that reports from just over half the sample have the ability to provide reliable information about network affiliation (Cairns et al, 1991). Unfortunately, in Spring of seventh grade only 119 (35%) students provided useable network information.

Networks and network identification. The following describes the procedure that was taken in order to generate the networks. Peer affiliation nominations were

initially assembled into a co-occurrence matrix (see Table 1 for an example). This matrix provided the frequency with which each child was nominated to belong to a group with any other child across the whole of seventh grade. NETJAWS (Kinderman & Mehees, 2009), a program specifically designed by network researchers at Portland State University to evaluate network nominations was used to conduct binomial z-tests to decide whether a student was more likely to be nominated to a group with another student than would be expected by chance.

Table 1: Representation of part of a co-nomination matrix

	Alex	Brett	Sam	Max	Total Group Nominations for each Individual
Alex	0	28	23	12	36
Brett	28	0	20	11	32
Sam	23	20	0	10	28
Max	12	11	10	0	29
No. of Groups Generated					694

For example, in computing the probability of whether Brett and Alex being assigned to the same group was greater than chance the computations would proceed as follows:

- The denominator would be the number of times Alex was assigned to be in any group, e.g. 36 times.
- The numerator would be the number of times Alex was nominated to be in a group with Brett, e.g. 28 times.
- Thus if Alex was assigned to be in any group 36 times but nominated to a group with Brett 28 times, the conditional probability of Brett and Alex being nominated to the same group, given that Alex has a group, would be $28/36 = .78$:
- This number would then be compared against the unconditional probability with which Brett was found in any group; that is, the number of times Brett was nominated to be in a group divided by the number of groups generated across the whole of seventh grade. For example if Brett was nominated to 32 groups in all, out of a total of 694 groups generated, this would result in the probability of .05 ($32/694$).
- A significant z-score of 21.47 would thus indicate that Brett was a member of Alex's group.

This procedure was followed for each child. Because there was the possibility of low expected cell frequencies Fisher's exact test was also used and only where both strategies are found to be significant were affiliative links accepted.

The benefit of this mechanism for constructing peer groups is that it allows students to be part of multiple groups simultaneously while still having peer connections that are unique to each individual. In this way each peer context is tailored specifically to each child and thus between child differences in contextual influences can be assessed.

Peer Network Characteristics

One hundred and ninety-eight seventh grade children, (58%) of the cohort, provided information about networks, making a total of 2,038 nominations; 541 overlapping networks of peers. Sixty-seven percent of the female cohort, and 49% of the male cohort provided information about these networks.

Composite group profiles for each student were computed by taking the mean of the teacher's reports of engagement across each individual's network while excluding the target student's score. For example, when looking at Figure 3, Debi's peer-group profile score of engagement is computed as the average score of each of Tami's, Kate's, Mari's and Trin's independently evaluated individual scores on engagement. Similarly, Jesse's peer-group profile score becomes the average score of each of Jen's, Nell's, Teri's and Evan's independently evaluated individual scores on engagement. Composite group profile scores were also computed for emotional engagement and behavioral engagement as described above.

Absolute person to group similarity was calculated by taking the target child's score on engagement and subtracting it from the group profile value in order to obtain an absolute value. Relative person to group similarity was calculated by computing correlations between individual engagement scores and group profile engagement scores.

Percentage of children of the same sex within each network was also computed since typically females tend to be more highly engaged than males. Network stability was calculated as a percentage of peer members retained across the school year, and lastly, the percentage of students' network located in the student's homeroom was calculated.

Isolates

A small proportion of seventh grade children (22%) had no peer network reported. Because teacher reports of engagement were used only 2% of those children with no peer network had no teacher report associated with them in Fall. Students with no peer network were assessed independently on levels of overall engagement, behavioral engagement and emotional engagement and then compared with those of the rest of the cohort in order to compute their similarity.

Chapter 8: Results

Analysis Strategy

As an alternative to friendship-study methodology Social Cognitive Mapping procedures (Cairns et al., 1985), were first employed to examine networks of peers who hung out together. The networks were considered to be the immediate context for individual academic development through the frequent interactions students would have with each other at school. A second goal of using this approach was to use a method that would be able to provide network information for the majority of children in the study. NETJAWS (Mehess & Kindermann, 2009) software was used to facilitate this. For details of this method see pages 32 and 76.

SPSS 22.0 statistical software was used to perform all preliminary analyses. These analyses were conducted in order to provide an initial indication of whether expected and hypothesized relationships existed amongst key variables in the study, and determine whether it made theoretical sense to include these variables into the substantive structural equation model for seventh grade students.

Finally, Amos 22.0 (originally developed by Arbuckle, 1999), was used for the substantive analyses to conduct structural equation modeling on the full set of relevant variables. These are the analyses at the heart of the project, namely examinations of peer influences on students' engagement in the classroom. Over the past several years this method has gained in popularity because of its advantages over the more traditional regression techniques from which it was developed. Specifically, it has advantages in its ability to account for measurement errors, correlated error terms, and in its ability to

compare multiple parameter estimates simultaneously across a complex hypothesized model while considering multiple endogenous and exogenous variables. Further, simultaneous significance of parameter estimates can be evaluated while considering the overall fit of the model to the data. Finally, Amos includes full information maximum likelihood procedures (FIML) to estimate coefficients where data are missing and therefore participants are not lost to the analysis due to missing data.

There are four steps to SEM: Model Specification; Model Identification; Model Estimation and lastly testing Model Fit.

Model specification involves the declaration of the theorized model by the researcher. This can be achieved by representing the model diagrammatically. Traditionally when diagramming the SEM model certain shapes have specific meanings. Hypothesized models are shown such that latent variables (constructs) are represented by an ellipse with arrows pointing from the ellipse toward the indicators (rectangles) by which they are measured. This is often described as the measurement part of the model.

All observed or measured variables are represented as rectangles and when used as exogenous variables are assumed with no error. Two headed arrows represent covariances and single headed arrows from exogenous to endogenous variables show the hypothesized direction of influence within the model. It is also during this stage that one asserts which parameters will be fixed or allowed to vary. Fixed effects can be used in order to set the metric range by which other parameters will be measured or to assess invariance between parameters.

The next step is model identification. The concept behind model identification is that there should be enough 'knowns' in the model such that a unique value can be estimated for each parameter with an unknown value. In order to estimate whether a model is *likely* to be identified one can count the number of data points, that is the number of sample variances and covariances, and compare this to the number of observed variables. The usual equation to estimate available degrees of freedom is $p(p+1)/2$ where p is equal to the number of observed variables. The parameters to be estimated are determined by adding the number of covariances, regression weights, and variances. If there are more data points than parameters to be estimated then the model is said to be over-identified and a unique solution is more likely to be found. If the number of data points available is equal to the number of parameters to be estimated the model is said to be just-identified: there are no degrees of freedom and the model cannot be tested. Should there be less data points than parameters to estimate the model is said to be under-identified and a solution is impossible to estimate. In this case the number of parameters can *technically* be reduced by fixing, constraining or deleting some of them (Ullman, 1996), but this should only be done in association with theoretical consideration.

Model estimation is the next step. This is an iterative process where the primary focus is to establish the discrepancy between the observed and estimated covariance matrices. By default Amos uses the maximum likelihood method which assumes a large enough sample size and multivariate normality. A chi-square difference test is then used in order to evaluate the difference between the empirical covariance matrix derived from the data and an estimated population covariance matrix that is consistent with the model.

The null hypothesis is that there is no difference between the two covariance matrices; in other words that the hypothesized model is consistent with the data. In reality, chi-square is very sensitive to sample size and with larger samples is likely to be significant (despite a non-significant chi-square being the desired outcome). Thus a second step is usually taken in which overall model fit is assessed.

For these analyses, three additional measures of fit were assessed: the CMN/df indicating the ratio of the chi-square to the degrees of freedom, this is an absolute fit index; the Comparative Fit Index (CFI), a non-centrality based index comparing the hypothesized model against the null (independence) model and lastly the Root Mean Square Error of Approximation (RMSEA). This is also a non-centrality based index, and is a measure of error.

Missing Data and Generalizability

Missing data are a problem facing all researchers and data analysts. There are few, if any, studies conducted in which 100% of survey questions to be answered have indeed been answered by all respondents, even in cross-sectional work. An additional difficulty facing those conducting longitudinal studies is that of participant attrition; participants failing to complete surveys or parts of surveys in later waves of data collection; nonetheless - despite all best efforts to reduce the likelihood of this occurring, to some extent it is an inevitable part of this type of data collection. For example, Enders (cf. Dong & Peng, 2013), suggested that missing data rates of 20% or more are common in educational studies; interestingly, there appears to be no rule of thumb threshold for determining when the amount of missingness is too great. Indeed, many studies fail to

describe their mechanism for dealing with missing data, or whether assumptions for dealing with missing data have been tested or met (Dong & Peng, 2013; Bodner, 2006).

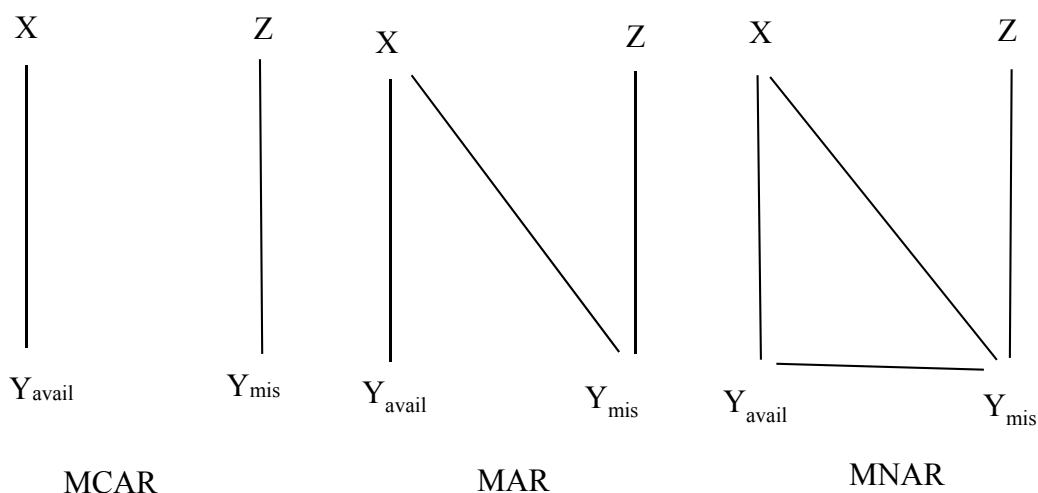
Traditionally, approaches such as listwise, or casewise deletion have been used to deal with the problem, but this can reduce power for finding statistical significance as well as produce biased estimates, particularly when there is a large proportion of missing cases (Graham, 2012). In longitudinal analyses, listwise and casewise deletion typically implies that only the most ‘reasonably adjusted’ individuals are left in the sample; often, these are analyses of “survivors” in a dataset. Most recently approaches such as multiple imputation (MI) or maximum likelihood (ML) have been used to address issues with missing data; while these mechanisms were designed to achieve unbiased estimates there is the assumption that for effective use data should be completely missing at random (MCAR), or at least missing at random (MAR). Given the terminology used for these concepts there may be some confusion in the real meaning of ‘random’ used in this context, particularly MAR.

Schafer and Graham (2002) provided a diagram (reproduced with slight modifications in Figure 5), to help illustrate the concepts of Missing Completely at Random (MCAR), Missing at Random (MAR), and Missing Not at Random (MNAR) in univariate data pattern.

In Figure 5, representing the missing data of one variable in each of the three situations MCAR, MAR and MNAR, X signifies the variables for which there is complete data; Y_{avail} , the available data for Y variable; Y_{miss} represents the missing Y

data, Z represents the reason for, or cause of the missing data, the lines represent connections between the concepts.

Figure 5:
Graphical representation of MCAR; MAR and MNAR as depicted (with minor modifications) by Schafer & Graham, (2002).



Under MCAR conditions the cause (Z), for missingness (Y_{miss}), is completely unrelated to X or Y_{avail} and may not even be captured in the dataset. For example, in the data, if X were individual achievement and Y were individual engagement, individual engagement would be considered MCAR if the reason for missingness was completely unrelated to the student's achievement or engagement. For example – if teachers failed to complete some of the student-engagement surveys due to lack of time then the reason (Z), would be entirely unrelated to achievement or the student's engagement and missing data could be considered MCAR.

Under MAR conditions, some of the causes (Z), for missingness (Y_{miss}) may be related to X but not Y_{avail} . Therefore, MAR holds if the probability of missingness is

unrelated to Y_{avail} once X has been controlled. In this example, it could be that teachers in lower achieving groups are busier than others; and therefore they fail to complete a portion of the engagement surveys. Therefore, the reason for missingness would be related to achievement but not directly related to the students' engagement.

Lastly, under the conditions of MNAR the cause (Z), for missingness (Y_{miss}) is related to both X and Y_{avail} . There are few situations in which missing data is MCAR, but several authors state that MAR is only an assumption and for the most part cannot be tested (Dong & Peng, 2013; Schafer & Graham, 2012). Further, in many cases making an assumption of MAR, when in reality this does not hold, may only have a minor impact on estimates and standard errors (Schafer and Graham; 2012, p.152).

In an analysis of missing data, Little's test of MCAR indicated that the missing data were not missing completely at random ($\chi^2 (771) = 996.53, p < .001$). There is no test for MAR, therefore based on the reading of the literature and the untested assumption that missing data would be MAR, the decision was made to use full information maximum likelihood (FIML) methods of estimation for the two major models. Using the Amos package, parameters are directly estimated using the raw data – which then “maximizes the ML function one case at a time, using whatever information is available for each case,” (Graham, 2012. p. 53). All preliminary analyses conducted in SPSS, and based on the same assumption of MAR, used the Estimation Maximization model embedded in SPSS to estimate missing values. In this process, the initial step is to estimate the means, variances and covariances for the data that is complete. This information is then used for ML estimation of missing data. The process is iterated until

there is convergence of missing information. In order to produce estimates that are more realistic the EM module also introduces some error into the final estimates so that standard errors are less likely to be underestimated. Information regarding missing data can be found in Appendix A.

Organizational Overview of the Results

The following sets of analyses are numerically ordered to be identical with the numbering of the original research questions. The first section presents the analyses associated with individual student characteristics. These analyses explore the characteristics of the seventh grade students in the town, their academic engagement, their perceptions of adult involvement, and how individual engagement, and perceptions of adult involvement may differ by sex. Also explored are potential differences between those students who completed surveys and/or were nominated to peer networks and those who were not, in order to understand whether results obtained can be considered to be generalizable across the whole of seventh grade.

The next set of analyses considers the networks themselves to discover whether SCM is a method that can account for the majority of students within seventh grade. This section provides information on the number of networks that were nominated, the make-up, size, structure and stability of the networks – as well as information on those students who failed to be nominated to a network. This is followed by analyses to assess the relationships between network characteristics and engagement.

Finally, grounded in Bronfenbrenner's bio-ecological model which assumes that micro-level interactions over time are the mechanism by which development occurs,

structural equation modeling is used, in two longitudinal models, to understand the contribution of the peer group to the development of individual engagement from Fall to Spring of seventh grade – while taking into account competing influences on development from parents and teachers, as well as controlling for network characteristics that are likely to be associated with network selection.

Descriptive Analyses

The following analyses used Full Information Maximum Likelihood to estimate missing data. Prior to FIML estimation the data were tested using Mahalanobis distance to identify multivariate outliers. Three cases exceeded the critical chi-square value and were deleted. It should also be noted that 20 students were on the school roster but had no 7th grade data therefore these cases were also excluded from analysis. It is possible that although these students were on the school roster for 7th grade, they had left the district prior to the beginning of Fall term of that year. The final data set for analysis contained 343 cases, thus unless stated otherwise subsequent analyses are based on a sample of 343.

Table 2 provides the inter-construct correlations for teacher and parent involvement, achievement and engagement variables. Table 3 presents the internal consistencies, means, standard deviations and stabilities for teacher report of student individual engagement in Fall and Spring, peer network engagement in Fall, and student report of teacher and parent involvement in the Fall. Prior to analyses internal consistencies using Cronbach's alpha were calculated for student engagement as well as parent and teacher involvement. Consistent with previous studies, internal consistencies

for all constructs were high (parent involvement $\alpha=.79$; teacher involvement $\alpha=.87$;
student engagement α range = .88 to .92).

Table 2: Inter-Construct Correlations

	Fall						Spring					
Fall	T-Involve	P-Involve	Achieve	Beh Eng	Emo Eng	Eng	Network Beh Eng	Network Emo Eng	Network Eng	Beh Eng	Emo Eng	Eng
T-Involve												
P-Involve	.09											
Achieve	.42**	.22**										
Beh Eng	.65**	.28**	.63**									
Emo Eng	.67**	.24**	.53**	.81**								
Eng	.69**	.28**	.62**	.96**	.93**							
Network Beh Eng	.41**	.20**	.10	.44**	.38**	.44**						
Network Emo Eng	.46**	.21**	.01	.42**	.48**	.47**	.85**					
Network Eng	.45**	.20**	.01	.45**	.42**	.47**	.97**	.95**				
Spring												
Beh Eng	.49**	.28**	.75**	.81**	.68**	.79**	.35**	.35**	.36**			
Emo Eng	.56**	.21**	.58**	.69**	.79**	.77**	.42**	.48**	.46**	.76**		
Eng	.56**	.27**	.73**	.81**	.77**	.83**	.40**	.42**	.42**	.96**	.91**	

Student Characteristics

Question 1.1. How engaged are students and how stable is their engagement from Fall to Spring?

As shown in Table 3, on a one to four scale teachers reported students to be highly engaged (overall Fall engagement mean = 3.21; overall Spring engagement mean = 3.05) with their engagement remaining highly stable from Fall to Spring ($r = .83$, $p < .01$). As would be expected, similar patterns were found for the sub-constructs of emotion and behavior in terms of magnitude of engagement and of engagement stability from Fall to Spring. This is consistent with previous studies (Newton-Curtis, 2006), and followed the expected pattern of results.

Table 3: Internal Consistencies, Means and Standard Deviations Student Engagement and Parent and Teacher Involvement.

			Fall		Spring		Fall to Spring Correlations
	□	Scale	M	SD	M	SD	
Student Variables							
Behavior Engagement	.91	1-4	3.01	.71	2.83	.61	.81**
Emotion Engagement	.88	1-4	3.41	.49	3.27	.39	.79**
Overall Engagement	.92	1-4	3.21	.57	3.05	.47	.83**
Network Engagement							
Behavior Engagement		1-4	3.05	.47	2.78	.39	.54**
Emotion Engagement		1-4	3.42	.34	3.28	.23	.47**
Overall Engagement		1-4	3.23	.39	3.03	.29	.52**
Academic Achievement							
		1-12	8.30	1.72			
Teacher and Parent Involvement							
Teacher Involvement	.87	1-4	3.09	.47			
Parent Involvement	.79	1-4	3.03	.69			

*** $p < .001$; ** $p < .01$; $p < .05$

Question 1.2. Are girls more engaged than boys, does engagement change over time and does engagement change differently depending on sex?

In order to answer this question a series of repeated measures analyses of variance were run, one for each component of engagement, and one for the combined engagement construct. There was a significant interaction between sex and overall engagement, and sex and emotional engagement. Both emotional and overall engagement declined from Fall to Spring with the extent of decline moderated by sex; in each instance the decline for males was a little steeper than for females (the interactions between sex and engagement from Fall to Spring are graphically represented in Figures 6 and 7); however, the magnitude of the difference was small in each case (partial eta squared = .01 and .01 respectively); further, on average males declined 4.5% on the 4-point scale in overall engagement, while females declined 3% in overall engagement. These are relatively large declines over the academic year for both sexes.

Figure 6: 7th Grade Emotional Engagement Fall to Spring

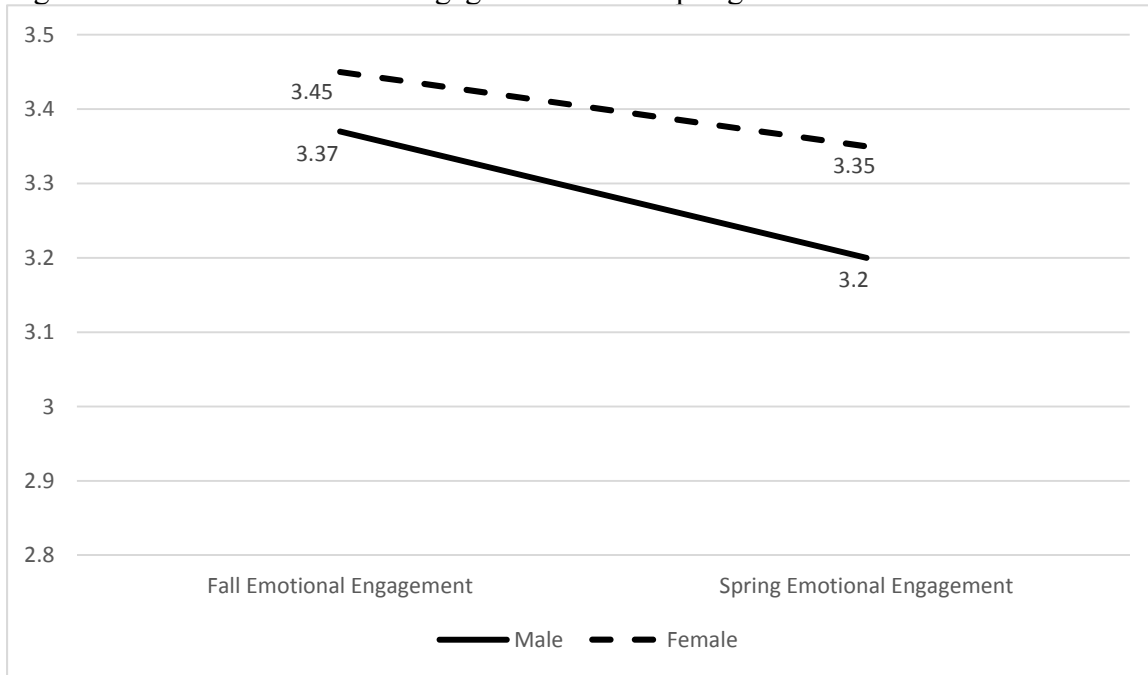
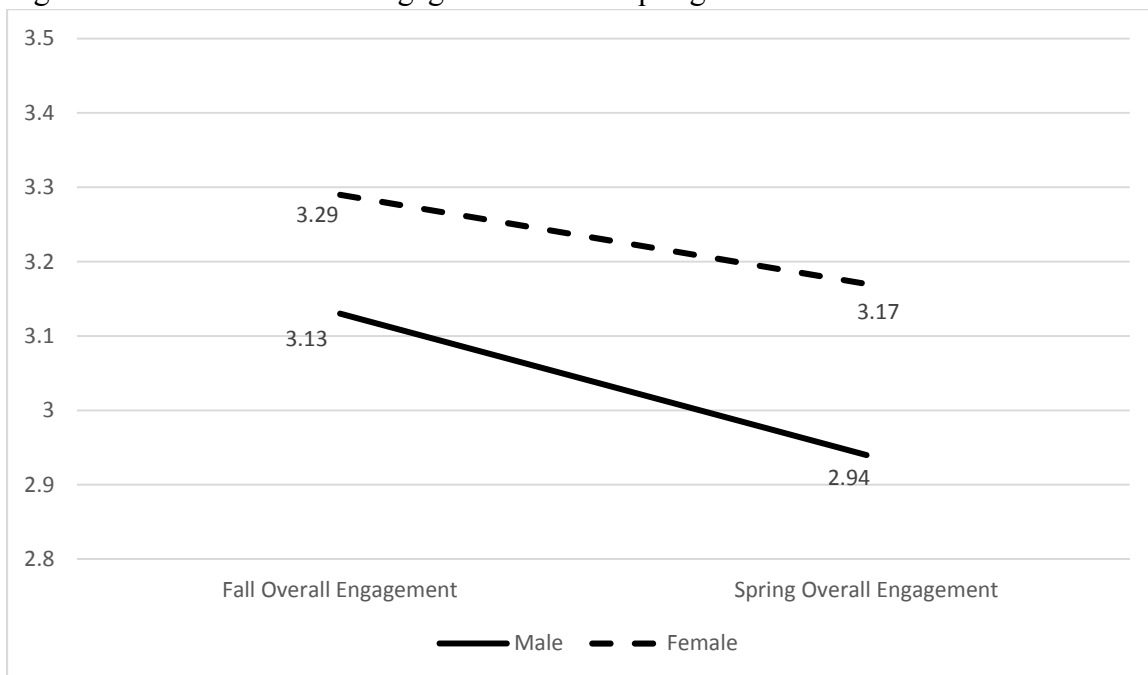


Figure 7: 7th Grade Overall Engagement Fall to Spring



Tables 4 and 5 provides the between subjects effects, the Fall to Spring means, standard deviations, significance levels and effects sizes for each of the analyses. It should be noted that the mean decline in motivation over time shown by these analyses is consistent with other studies (Gottfried et al, 2001), where in the transition from elementary school to middle school other research has found evidence for sharp declines in engagement (Eccles, Midgley, Wigfield, Buchanan, Reuman, Flanagan, & MacIver, 1993; Skinner, Zimmer-Gembeck, & Connell, 1998). Once again, the results shown here are consistent with those expected for the current analyses.

Table 4: Between-subjects Effects of Sex on Engagement.

	F	df	Partial Eta Squared
Behavior Engagement	17.26***	1(341)	.05
Emotional Engagement	6.46*	1(341)	.02
Overall Engagement	13.49***	1(341)	.04

*** $p < .001$; ** $p < .01$; * $p < .05$

Table 5: Within-Subjects Effects of Sex on Engagement

	Fall Behavior Engagement		Spring Behavior Engagement		F	df	Partial Eta Squared
	M	SD	M	SD			
Male	2.89	.78	2.67	.64			
Female	3.13	.61	2.99	.53	62.82***	1(341)	.16
Behavior Interaction	3.01	.71	2.83	.61	3.27	1(341)	.01
	Fall Emotion Engagement		Spring Emotion Engagement		F	df	Partial Eta Squared
	M	SD	M	SD			
Male	3.37	.51	3.20	.39			
Female	3.45	.46	3.35	.37	68.47***	1(341)	.17
Emotion Interaction	3.41	.49	3.27	.39	3.92*	1(341)	.01
	Fall Overall Engagement		Spring Overall Engagement		F	df	Partial Eta Squared
	M	SD	M	SD			
Male	3.13	.61	2.94	.48	84.08***	1(341)	.20
Female	3.29	.51	3.17	.43			
Overall Interaction	3.21	.57	3.05	.47	4.56*	1(341)	.01

*** p<.001; ** p<.01; *p<.05

Question 1.3. Are there differences in terms of engagement for participants versus non-participants?

The first set of analyses assessed differences in engagement between student respondents and student non-respondents to parent involvement surveys. The second set of analyses were similar to the first but assessed differences in engagement based on response/non-response to teacher involvement surveys. The final set analyzed the differences in engagement between students who made peer network nominations and those who did not, based on behavioral, emotional and overall engagement. It should be noted that one reason for non-response to a survey or for failure to complete peer nomination forms would be a school absence, and so failure to complete a form would not necessarily mean a direct refusal.

Parent involvement survey completion. Thirty-three (9%) of the seventh grade students did not provide their perceptions of parent involvement; however, as shown in Table 6, independent sample t-tests revealed no significant differences between students who completed surveys when compared with those who did not complete surveys on their respective magnitudes of engagement in Fall; respondents and non-respondents were similarly engaged. In Spring however, there was a significant difference between respondents and non-respondents for emotional engagement ($t(341) = 2.25, p < .05$), with the magnitude of emotional engagement somewhat lower for non-respondents than respondents.

Table 6: Fall Student Parent-Survey Respondents vs. Non-Respondents on Fall and Spring Engagement

	Respondent (N=310)		Non- Respondent (N=33)		t	df	d
	Fall						
	M	SD	M	SD			
Behavioral Engagement	3.02	.71	2.87	.72	1.15	341	.12
Emotional Engagement	3.42	.48	3.27	.50	1.71	341	.18
Overall Engagement	3.22	.57	3.07	.58	1.49	341	.16
	Spring						
Behavioral Engagement	2.84	.61	2.70	.61	1.25	341	.13
Emotional Engagement	3.28	.38	3.13	.40	2.25*	341	.24
Overall Engagement	3.06	.46	2.91	.47	1.73	341	.19

*** p<.001; ** p<.01; *p<.05

Teacher involvement survey completion. Thirty-nine (11%) of the seventh grade students did not provide their perceptions of the degree of teacher involvement with them. In all instances independent t-tests revealed significant differences on sub-constructs as well as the overall construct of engagement for Fall and Spring; students who completed surveys were more highly engaged than those who did not. Cohen's d effect sizes were moderately large ranging from .33 to .54 (see Table 7), and were larger in Spring than in Fall.

Table 7: Fall Student Teacher-Survey Respondents vs. Non-Respondents on Fall and Spring Engagement

	Respondent (N=304)		Non- Respondent (N=39)		t	df	d
	Fall						
	M	SD	M	SD			
Behavioral Engagement	3.03	.73	2.82	.52	2.32*	59.31	.33
Emotional Engagement	3.43	.50	3.27	.38	2.29*	56.04	.36
Overall Engagement	3.23	.58	3.04	.43	2.38*	56.95	.37
	Spring						
Behavioral Engagement	2.85	.61	2.58	.56	2.68**	341	.46
Emotional Engagement	3.29	.38	3.10	.31	3.50**	54.29	.54
Overall Engagement	3.07	.47	2.84	.40	2.97**	341	.52

Network nomination completion. For the third set of analyses three independent samples t-tests were run to assess differences between those students who made peer network nominations and those who did not, on academic engagement in Fall. Analyses were repeated to understand whether informants and non-informants differed in engagement in Spring. Table 8 illustrates significant differences between those students who nominated peers to networks and those who did not on both the Fall and Spring sub-components of engagement and on overall engagement. Students who completed peer nominations tended to be more highly engaged than those who did not (Fall overall-engagement: 3.26 and 3.13 respectively, $t(341) = 2.56, p < .05$; Spring overall engagement 2.89 versus 2.74, $t(341) = 2.56, p < .05$). All effects sizes were relatively small (Cohen's d range = .21 to .28), indicating that although the difference was significant the magnitude of difference was small.

Table 8: Fall Informants vs. Non-Informants on Fall and Spring Engagement

	Informant (N=198)		Non-Informant (N=145)		t	df	d
	Fall						
	M	SD	M	SD			
Behavioral Engagement	3.08	.69	2.92	.74	2.03*	341	.22
Emotional Engagement	3.45	.46	3.35	.51	1.96*	341	.21
Overall Engagement	3.26	.55	3.13	.59	2.09*	341	.23
	Spring						
Behavioral Engagement	2.89	.60	2.74	.61	2.21*	341	.25
Emotional Engagement	3.32	.39	3.21	.38	2.73**	341	.28
Overall Engagement	3.10	.46	2.98	.48	2.56*	341	.25

*** p<.001; ** p<.01; *p<.05

Despite the majority of these results being contrary to initial expectations, in retrospect these results may not be surprising. Academic endeavors require a certain level of motivation and so did the task of completing surveys and/or writing down, from free recall, the names of students who would hang out together. It is possible that students who decided not to make peer nominations saw this task as being similar to an academic task and lacked motivation to complete the task. It should be noted that while there was some overlap between those students who failed to complete teacher involvement, parent involvement and peer network nomination surveys only 10 (2%) students had incomplete data on all three; therefore, the decision was made that it would be appropriate to include all students into the final models; however, it should be noted that students who nominated others in the student body to networks saw their teachers as more highly involved with them ($t(341) = 2.84, p < .01, d = 0.31$) and had more social connections to fellow peers ($t(341) = 3.77, p < .001, d = 0.41$; see Table 9).

Table 9: Fall Student Nominators vs. Non-Nominators on Teacher Involvement, Parent Involvement and Social Inclusion

	Respondent (N=198)		Non- Respondent (N=145)		t	df	d
	Fall						
	M	SD	M	SD			
Teacher Involvement	3.11	.43	3.08	.51	0.52	341	.05
Parent Involvement	3.12	.68	2.90	.69	2.84**	341	.31
Social Inclusion	6.06	.531	4.14	4.14	3.77***	339.51	.41

*** p<.001; ** p<.01; *p<.05

Question 1.4. Are there differences in engagement between those who were not identified as having a network when compared with those who were identified as having a network?

Table 10 suggests there were no significant differences in Fall between those students who were identified as having a network and those who were not identified as having a network ($t(101.94) = 1.78$, ns). This was contrary to expectation; in retrospect, this may not be as counterintuitive as it seems at first blush. Kindermann (2007) found that the majority of students who were not identified as having a network in sixth grade nevertheless identified others as friends, or were identified by someone as a friend, and so would not be classed as a social isolate (friendships were not analyzed for the current study); so it is possible that a similar pattern holds for the students in seventh grade. It should be noted that in assessing achievement scores between groups – once again, no significant differences were observed between those who were identified as having network affiliations and those who were not. From a purely visual inspection of the raw data only two students were consistently identified by their peers as preferring to ‘hang out’ by themselves and thus who might be considered isolates – even so, it is unknown

whether these students were actively ‘rejected’ by their peers, a situation in which research suggests they would likely be at risk for academic failure, or if they were alone for some other reason.

Table 10: Students Identified as having a Network Compared with those with No Network in Fall on Engagement

	Network (N=270)		No Network Identified (N=73)		t	df
	M	SD	M	SD		
Behavioral Engagement	3.05	.69	2.87	.78	1.79	104.29
Emotional Engagement	3.43	.46	3.32	.56	1.76	341
Overall Engagement	3.22	.56	3.14	.64	1.77	101.93
Achievement	8.38	1.76	8.02	1.66	1.59	341

*** $p < .001$; ** $p < .01$; * $p < .05$

Question 1.5. Is cognitive ability associated with engagement?

Bivariate correlations (Table 2) indicate a strong positive concurrent correlation between academic achievement and engagement in the Fall of seventh grade, and a strong correlation from Fall achievement to Spring individual engagement. This suggests that achievement should also be accounted for as a covariate when exploring the contribution of network peer profiles on individual outcomes.

Question 1.6. How involved do students perceive their parents and teachers to be and does this differ by sex?

Table 2 illustrates that parents and teachers were both perceived by students to be relatively involved in their lives (parent involvement mean = 3.02, SD = .69; teacher involvement mean = 3.09, SD = .47), but the results of independent t-tests (Table 11), revealed that females perceived parents to be significantly more involved than did boys ($t(341) = 2.60, p < .05$); however, there were no significant differences between girls and

boys in their perceptions of teacher involvement ($t(341) = 1.78$, ns). This result is contrary to evidence from some studies that have indicated that at this age teachers tend to pay more attention to boys (e.g., Einarsoon, Granstrom, 2002; Nairn, 1995), which is important to note given the importance of both parent and teacher support to classroom motivation (Wentzel, 1998).

Table 11: Differences in Male and Female Students' Perceptions of Parent and Teacher Involvement

	Girls		Boys		t	df	d
	M	SD	M	SD			
Parent Involvement	3.13	.73	2.93	.65	2.60*	341	.28
Teacher Involvement	3.14	.43	3.05	.49	1.78	341	.28

*** $p < .001$; ** $p < .01$; * $p < .05$

As shown in Table 3 parent and teacher involvement were both significantly correlated with individual student engagement in the Fall ($r = .69$, $p < .01$; $r = .27$, $p < .01$) and in the Spring ($r = .55$, $p < .01$; $r = .27$, $p < .01$), but because females were shown to be more engaged than males, and because females tended to perceive parents to be more involved with them than boys a series of simultaneous regression analyses were conducted to explore whether parent and teacher involvement were still significantly associated with engagement when controlling for sex. These analyses were run for each subcomponent of engagement, and overall-engagement for both Fall and Spring. As shown in tables 12 and 13, in each instance parent and teacher perceptions of involvement remained predictive of engagement indicating the importance of parent and teacher involvement on student outcomes regardless of the student's sex. Once again,

these results go hand-in-hand with several studies that have shown the importance of teacher involvement and teacher-student relations in student motivation for learning (e.g. Opendakker, Maulana & den Brok, 2012; Martin & Dowson, 2009), as well as studies showing the importance of parental involvement to positive motivational trajectories particularly across the period of school transitions (Ratelle, Guay, Larose and Senecal, 2004), and add support to the inclusion of parent and teacher contributions to engagement within the core models.

Table 12. Effects of Parent Involvement on Individual Engagement While Controlling for Sex

		Fall			
		F	R ²	β	t
Behavioral Engagement	Full Model	12.99	.08***		
	Sex Parent Involvement			.13 .24	2.34* 4.09***
Emotional Engagement	Full Model	8.56	.06***		
	Sex Parent Involvement			.05 .22	.92 3.83***
Overall Engagement	Full Model	12.12	.08***		
	Sex Parent Involvement			.11 .24	1.85 4.20***
		Spring			
		F	R ²	β	t
Behavioral Engagement	Full Model	9.66	.06***		
	Sex Parent Involvement			.17 .16	2.90** 2.79**
Emotional Engagement	Full Model	19.91	.12***	.24	4.21***
	Sex Parent Involvement			.22	3.95***
Overall Engagement	Full Model	17.38	.11***		
	Sex Parent Involvement			.22 .21	3.92*** 3.71***

*** p<.001; ** p<.01; *p<.05

Table 13: Effects of Teacher Involvement on Individual Engagement While Controlling for Sex

		F	R ²	β	t
Behavioral Engagement	Full Model	101.82***	.42		
	Sex Teacher Involvement			.10 .63	2.13* 13.75***
Emotional Engagement	Full Model	105.02***	.43		
	Sex Teacher Involvement			.01 .65	.25 14.35***
Overall Engagement	Full Model	122.38***	.46		
	Sex Teacher Involvement			.07 .67	1.50 15.28***

		F	R ²	β	t
Behavioral Engagement	Full Model	68.52***	.38		
	Sex Teacher Involvement			.13 .54	2.65** 10.99***
Emotional Engagement	Full Model	64.31***	.31		
	Sex Teacher Involvement			.22 .49	4.33*** 9.89***
Overall Engagement	Full Model	76.73***	.35		
	Sex Teacher Involvement			.19 .54	3.99*** 11.16***

*** p<.001; ** p<.01; *p<.05

Summary of student characteristics. Students completed teacher and parent involvement surveys as well as network affiliation nominations while teachers completed student engagement surveys for each student. When compared with students who completed peer affiliation nominations, students who did not complete network nominations tended to be less engaged on average, perceived their parents to be less involved and were less socially connected to peers; however, as a group, students in seventh grade tended to be relatively highly engaged in Fall and Spring despite a decline in overall engagement across the academic year. Female students tended to be somewhat more engaged than boys, with boys' academic engagement tending to decline at a faster rate than females' from Fall to Spring. On average students perceived both teachers and parents to be moderately highly involved with them. There were no differences in the extent of teacher involvement perceived by students but girls perceived their parents to be more highly involved with them than did boys.

Network Characteristics

Social cognitive mapping was specifically designed to accommodate large proportions of non-respondents regarding peer networks without loss of network information. Cairns and Cairns (1994) recommend that a minimum of about 50% of the people in a setting should participate in data collection in order to establish a valid and reliable network structure. In the current study 58% (n=198) participated in the Fall nominations of peer networks. SCM allows for smaller participation rates because it relies on observations of many reporters. Peer groups can be observed and reported on by

others even if the person affiliated with the peer group is absent on the day data are collected. This is a major strength of this methodology.

Question 2. Is SCM a method that can allow for all, or nearly all, possible children within the population of interest to be accounted for when social networks have been created?

Three hundred and twenty-seven children, 94% of the seventh grade cohort, were nominated to a peer group in the Fall of seventh grade however, not all met the threshold for significant peer network linkages based on a combination Fisher's Exact² test and a significant binomial z-test. At the beginning of 7th grade 78% (N = 270) of the cohort were identified as having significant network ties. Networks consisted of between 0 and 20 members, with an average size of 5.29 (SD = 5.04) members. Ninety-eight percent of the students' network linkages were with other seventh graders but network members were also nominated from 5th and 6th grade. Thirteen percent of the identified networks consisted of dyads.

Network inclusion. Of those with no identified network 57 were boys, 16 were girls. In Spring 12 of the girls and 43 of the boys still remained with no observed network. As described previously, for those who had no network identified in Fall or Spring there were no significant differences in the degree of Fall or Spring engagement (see Table 10); it is possible – based on a comparison of friendship and peer nominations data from previous research (Kindermann, 2007) – that these students may have had unobserved peer connections, that were not captured in the network nominations.

Network makeup. On average, ninety-one percent of the members of a student's network were of the same sex (mean = .91, SD = .16). Seventy-seven percent of the students' networks had members exclusively of the same sex, 21% of the networks were a mix of males and females, and two percent of the students had networks comprised solely of the opposite sex. Thirty-seven percent of network members were from the same homeroom; however females tended to have significantly fewer ties with students *within* their homeroom than did males ($t(341) = -4.95, p < .001$).

Network stability. Over the course of the year a student's network, on average maintained 49% of its original members (average number of network members kept = 3.34; range = 0 - 13). A two-way anova indicated that females' networks were more stable than males. Females kept approximately 56% of their network members compared with 43% for males ($F(1,339) = 27.78, p < .001$), and more highly engaged groups (median split) were more stable than less engaged groups; networks that were more highly engaged retained 53% of group members compared with 46% of group members in less engaged groups ($F(1,339) = 6.07, p < .05$).

Summary Network Characteristics. For Fall, the number of students who nominated other students to networks fell within the boundaries recommended by Cairns & Cairns (1994) that have been shown in past analyses to produce reliable network affiliations. Over 90% the students within seventh grade were nominated to a network but when assessing only significant connections, this fell to 78% of the children having significant linkages with others. In general peer-groups were made up of about five children and the majority of these children came from within the seventh grade cohort.

Networks tended to be composed of children of the same sex; however, approximately one fifth of the networks were comprised of both sexes. The majority of those children who had no significant tie to a network were boys, and if a child was without significant ties in Fall, they tended to remain that way through Spring. Over the course of the academic year network membership turnover was around 50%; however, girls' networks had more membership stability than did boys', and highly engaged networks had more membership stability than less engaged groups.

Network Characteristics and Their Relationship to Engagement

Question 3.1. To what extent are network profiles of engagement from Fall to Spring shown to be stable? When overall engagement is decomposed into group profiles of behavioral engagement and emotional engagement does the strength of stability remain the same?

Cross-time profiles of network engagement were shown to be moderately stable from Fall to Spring (see Table 3), with bivariate correlations ranging from .47 to .54. This suggests that despite the relatively extensive turnover in a student's network, students tended to maintain connections with similarly engaged peers. Given this information, it is possible that influence from peers may continue to exert a stable influence on engagement across the academic year.

Question 3.2. Are peer groups motivationally homogenous? Is there motivational homogeneity within networks, and between networks and individuals when the engagement construct is broken down into the subcomponents of emotional and behavioral engagement?

Networks were relatively motivationally homogenous with standard deviations around the mean scores for network profiles of engagement constructs ranging between .23 and .47: all within a half standard deviation of the mean score. And as expected moderately strong concurrent correlations were found between individual constructs of engagement and network profiles of engagement in the Fall (r range = .38, $p < .01$ to .48, $p < .01$), and moderate concurrent correlations between Spring individual engagement and Spring network profiles of engagement (r range = .25, $p < .01$ to .31, $p < .01$; Tables 2 and 14).

Table 14: Correlations Between Concurrent Spring Individual and Network Engagement

	Beh Eng	Emo Eng	Eng	Network Beh Eng	Network Emo Eng	Network Eng
Beh Eng						
Emo Eng	.76**					
Eng	.94**	.91**				
Network Beh Eng	.29**	.26**	.30**			
Network Emo Eng	.25**	.30**	.29**	.78**		
Network Eng	.29**	.29**	.31**	.97**	.91**	

*** $p < .001$; ** $p < .01$; * $p < .05$

To further explore the relationship between the network and individuals within the network, a series of paired sample t-tests were conducted to assess differences between concurrent Fall individual and network engagement profiles, followed by concurrent Spring individual and network engagement profiles. The results of these tests further supported motivational homogeneity between individual and network. No significant mean differences were found between concurrent analyses of individual and network engagement in Fall or Spring (and all paired difference standard deviations were

less than one standard deviation see Table 15). Similarly, a correlation using the score of absolute mean differences between person and network indicated the correspondence between the network and individual at baseline ($r = -.21, p < .001$). Finally, as shown in table 16, as the difference between the peer network profile and the individual reduced so individual engagement was shown to increase.

Table 15: Mean Differences and Standard Deviations of the Differences Between Individuals and Networks Based on Engagement

Fall Concurrent Differences between Individual and Network Profile of Engagement	Mean Difference	SD of the Difference	t
Indiv Beh – Net Profile Beh	-.07	.66	-1.06
Indiv Emo – Net Profile Emo	-.01	.44	-.57
Indiv Overall Eng – Net Profile Overall Eng	-.03	.52	-.91
Spring Concurrent Differences between Individual and Network Profile of Engagement			
Indiv Beh – Net Profile Beh	.04	.62	1.34
Indiv Emo – Net Profile Emo	-.01	.39	-.54
Indiv Overall Eng – Net Profile Overall Eng	.02	.47	.66

*** $p < .001$; ** $p < .01$; * $p < .05$

Question 3.3. To what degree are stability and size of the peer network associated with motivation?

As shown in table 16, bivariate correlations suggested that both the size of the network and the stability of the network was positively related to individual engagement and network engagement. Because females networks tended to be associated with more stable networks ($r = .35, p < .001$), a simultaneous regression was run to test whether the significant relationships between network stability and network engagement, was maintained when controlling for sex. As expected, even when controlling for sex –

network stability continued to make a positive unique contribution to the variance in network engagement ($\beta = .16$; $t = 5.09$, $p < .01$).

Table 16: Bivariate Correlations between Individual Fall and Spring Engagement, Network Size, Network Stability and Sex.

	Network Size	Network Stability	Person to Group Difference	Sex
Fall Beh Eng	.11*	.24**	-.45**	.17**
Fall Emo Eng	.14*	.25**	-.34**	.08
Fall Overall Eng	.13*	.24**	-.43**	.14**
Fall Network Eng	.15**	.25**	-.21**	.28**
Spring Behavioral Engagement	.23**	.22**	-.28**	.19**
Spring Emo Eng	.14**	.33**	-.31**	.26**
Spring Overall Eng	.19**	.30**	-.32**	.25**
Spring Network Eng	.19**	.31**	-.32**	.25**

*** $p < .001$; ** $p < .01$; * $p < .05$

Question 3.4. Do mean differences exist between homerooms on Fall ratings of engagement?

As a reminder: students' homeroom assignments were made based on administrative needs. Typically, students were assigned to a homeroom with a teacher who knew that student well. Homeroom classes were held every day for approximately 20 minutes. This is important to note because a homeroom assignment did not mean that a student spent all day in that homeroom but rather, a small portion of the day.

Accordingly, only 37% of a student's network was shown to be located in the same homeroom. In the transition from sixth to seventh grade, the data indicated a substantial

reshuffling of students to different homerooms. On average a student was transferred to a 7th grade homeroom together with only 2 classmates from the students' previous, 6th grade homeroom (range = 0 – 5). It was therefore necessary to understand whether there were any differences in motivation between classrooms because homeroom academic climate could have some (minor) influence on students' academic outcomes. Three analysis of variance computations were conducted to assess differences between homerooms on each of the sub-constructs and overall construct of engagement. Results of the analyses provided support for significant differences in engagement between classrooms (behavioral engagement: $F(14,328) = 5.00, p < .001$; emotional engagement: $F(14,328) = 10.52, p < .001$; overall engagement: $F(14,328) = 7.11, p < .001$). Homeroom overall engagement scores ranged from 2.72 to 3.72 indicating the variability of engagement between them. Means and standard deviations for the engagement sub-constructs and the overall engagement construct, broken down by classroom, can be found in table 17. It was decided that the homeroom was a possible candidate for inclusion into the major models as a control variable; nonetheless, it should also be re-emphasized that students spent a very small proportion of their day in the homeroom (approximately 20 minutes). The homeroom was primarily used for the administrative task of assuring students were at school and providing them with school related notices and announcements.

Table 17: Means and Standard Deviations of Fall Individual and Network Engagement Based on Homerooms

Homeroom N	Indiv Beh Eng		Indiv Emo Eng		Indiv Overall Eng		Network Beh Eng		Network Emo Eng		Network Overall Eng	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
19	2.52	.59	2.92	.36	2.72	.46	2.61	.58	3.07	.38	2.83	.47
23	2.73	.90	3.37	.47	3.05	.66	2.88	.56	3.35	.35	3.12	.44
19	3.40	.62	3.76	.32	3.58	.46	3.44	.27	3.77	.12	3.61	.20
27	2.84	.45	3.02	.38	3.02	.38	2.97	.20	3.28	.17	3.15	.16
27	2.78	.52	3.01	.27	2.90	.35	3.02	.42	3.28	.28	3.15	.33
22	3.35	.73	3.70	.35	3.53	.51	3.32	.63	3.64	.43	3.48	.51
21	2.79	.93	3.26	.66	3.02	.76	3.93	.44	3.27	.29	3.10	.35
24	2.63	.51	3.06	.44	2.84	.47	2.91	.43	3.30	.35	3.11	.37
23	3.20	.60	3.41	.41	3.31	.47	3.15	.41	3.50	.27	3.32	.32
24	2.98	.80	3.47	.50	3.22	.63	2.90	.54	3.32	.42	3.11	.48
20	3.31	.65	3.45	.48	3.90	.56	3.78	.23	3.69	.14	3.53	.17
25	3.59	.45	3.86	.33	3.73	.39	3.21	.32	3.58	.22	3.96	.24
23	2.89	.57	3.57	.31	3.23	.43	2.98	.33	3.55	.19	3.27	.25
26	2.97	.71	3.42	.41	3.19	.54	2.93	.44	3.32	.30	3.13	.36
20	3.20	.68	3.71	.27	3.46	.47	3.09	.43	3.46	.26	3.28	.33

Summary of network characteristics and their relationship to engagement.

Networks tended to sustain their quality of engagement from Fall to Spring suggesting that even though there was membership turnover students maintained ties and/or selected new affiliations with others of a similar quality of engagement. In general the peer networks were motivationally homogenous in Fall and in Spring. Children with larger networks tended to be more engaged, and more stable networks were related to higher

individual engagement. The quality of engagement differed between homerooms but students' networks tended to cross homeroom boundaries with approximately two thirds of an individual's network on average being with children from one or more different homerooms.

Peer Networks and Student Engagement from Fall to Spring

The core analyses were designed to understand whether students' peer networks, identified in the Fall, could be attributed as socializing forces on student engagement at the end of the academic year when controlling for characteristics upon which students might select, and for other socializing agents that might wish to deliberately influence academic engagement.

Major question 1. Can Fall peer group engagement profiles predict Spring individual engagement in a cohort of seventh grade students when controls are used for network structural characteristics that may be a result of selection, and/or the effects of influences outside of the peer network such as teachers and parents?

It is possible that network affiliation could arise as a direct result of academic engagement; however, in reality there are many factors that can influence a student's reasons for affiliation with other peers, and some of these tangential reasons may indirectly position a student to associate with others who are similarly engaged. In an attempt to disentangle socialization influences from influences that could be attributed to selection several controls were used. Based on the preliminary analyses, variables that appeared to be a result of selection and that characterize the configuration of the networks were chosen as the first group of controls:

- Network size, because larger groups tended to be more engaged.
- Network stability, because stable network members tended to be more engaged. This also allowed for ‘dosage’ of network members’ interactions with the focal student to be controlled.
- The percentage of a student’s network that was from the same class because peers within networks were unevenly distributed across classrooms.

The second set of controls were related to the degree to which the student’s engagement in Spring was a result of influences external to the peer network.

- Teacher involvement, because higher perceptions of teacher-involvement were associated with increased individual engagement.
- Parent involvement, because higher perceptions of parent-involvement were associated with increased individual engagement.

Another set of controls related to similarity of individual to group (homogeneity) were chosen.

- Sex, because there were differences between males and females in degree of engagement and in rates of engagement decline and because typically, networks tended to be primarily composed of the target student’s own sex. In effect sex was included to disentangle overall network effects from student trajectories of engagement that were based on highly engaged girls (affiliated with other highly engaged girls) versus low engaged boys (affiliated with other low engaged boys). .

- The degree to which the network consisted of same-sex members, because on the whole, students appeared to prefer to hang-out with members of their own sex and this was correlated with network and individual engagement.
- The similarity in engagement between the individual and network, because those who were closer in similarity to the network were more highly engaged.

One final control was added to the primary models, that of academic achievement. While this was not, based on Fall bivariate correlations, something upon which students appeared to select network affiliates, it has been shown in many studies to be associated with academic motivation and is something that should be accounted for when attempting to understand the socialization influences of the peer group on motivation over time.

Figure 8. Cross-Lagged Peer Group Prediction of Individual Engagement Controlling for Assortiveness Indicators

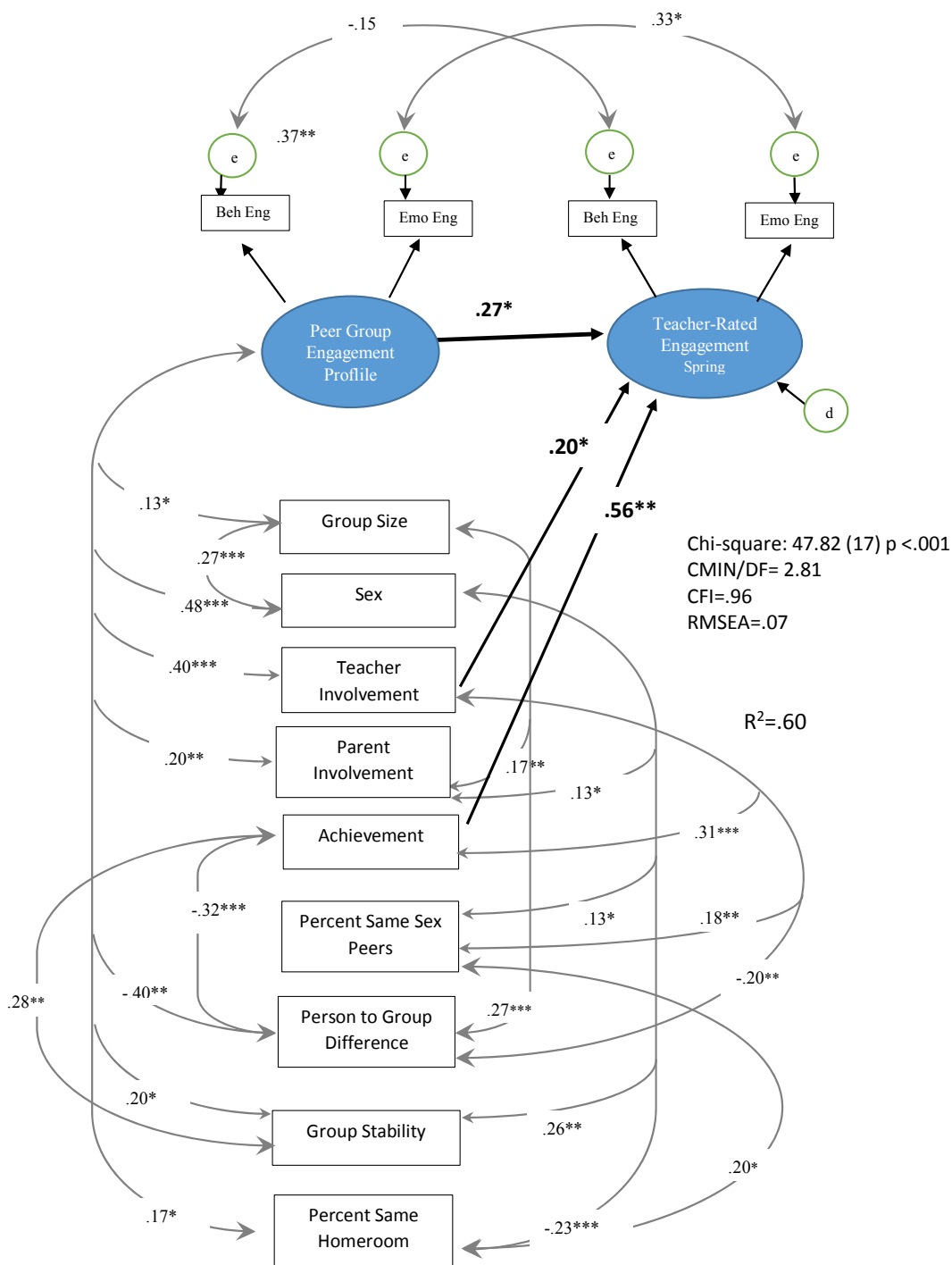


Figure 8 presents a pictorial representation of the model. For visual simplicity, only those relationships that reached statistical significance are represented here (see appendix B for the full set of parameter estimates). As shown in the figure, the chi-square test also reached significance (Chi-square=47.82, $p<.001$). Ideally, a non-significant chi-square would be desired (suggesting there is no significant difference between observed and estimated covariances). However, chi-square is extremely sensitive to sample size and often shows significance even when other indices indicate a good or adequate fit of the model to the data. Consequently, the value of this statistic is also weighed against other indices of fit.

- CMIN/df; the ratio of the chi-square to the degrees of freedom is an absolute fit index. Magnitudes of less than 3:1 are desired.
- The Comparative Fit Index (CFI), is a noncentrality-based, relative index of fit comparing the hypothesized model against the null (independence) model and ranges from 0 to 1. Magnitudes greater than .90 are considered good.
- Root Mean Square Error of Approximation (RMSEA), the difference between the observed and estimated model covariances is a non-centrality chi-square based index. It is a measure of error. Values of .05 or less suggest low error; however, less than .10 are typically considered acceptable.

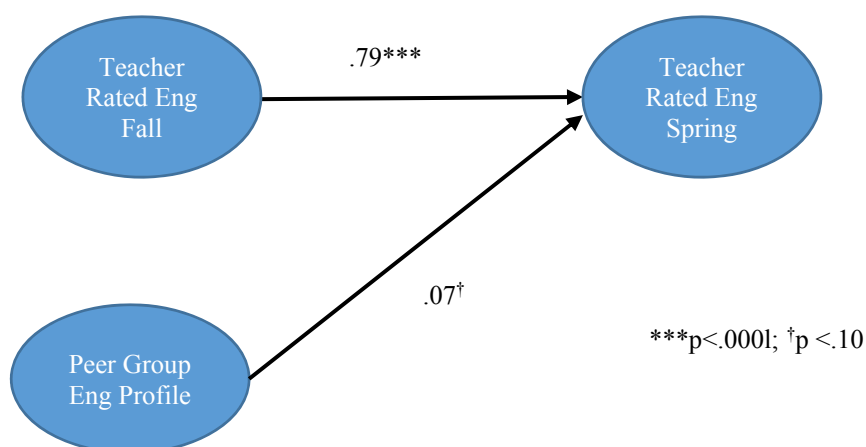
As can be seen in figure 8, the model fit was acceptable based on the measures of fit described (CMIN/df = 2.81; CFI=.96; RMSEA=.07). Peer group influence was predictive of teacher-rated individual engagement in Spring over and above student peer selection and parent or teacher influences. The full model explained 60% of the variance in Spring

individual engagement, with assortiveness variables explaining 54%. Clearly *selection* to a peer network contributed to the variance explained, but it is likely that socialization influences from the network itself explain part of the development of engagement. Nonetheless, in order to definitively understand whether socialization influences are predictive of Spring engagement the students' respective individual engagement should also be controlled³.

Major question 2. Do Fall peer group engagement profiles remain significantly related to Spring individual engagement when assortiveness variables are controlled *and* when controlling for the students own level of engagement in the Fall?

An initial analysis was conducted using simultaneous regression to explore whether peer influence in engagement could be predicted from fall peer affiliations only for those students who had non-missing network profiles. Figure 9 shows that while controlling for students quality of engagement in the fall peer group influence on engagement trended towards significance. Because the data showed a slight deviation from the normal distribution the analysis was re-run with the use of bootstrapping (1000 samples). This indicated a significant result ($p < .05$; CI .007 to .154). However, as can be seen in the figure the Beta was small as was the partial correlation ($r=.11$).

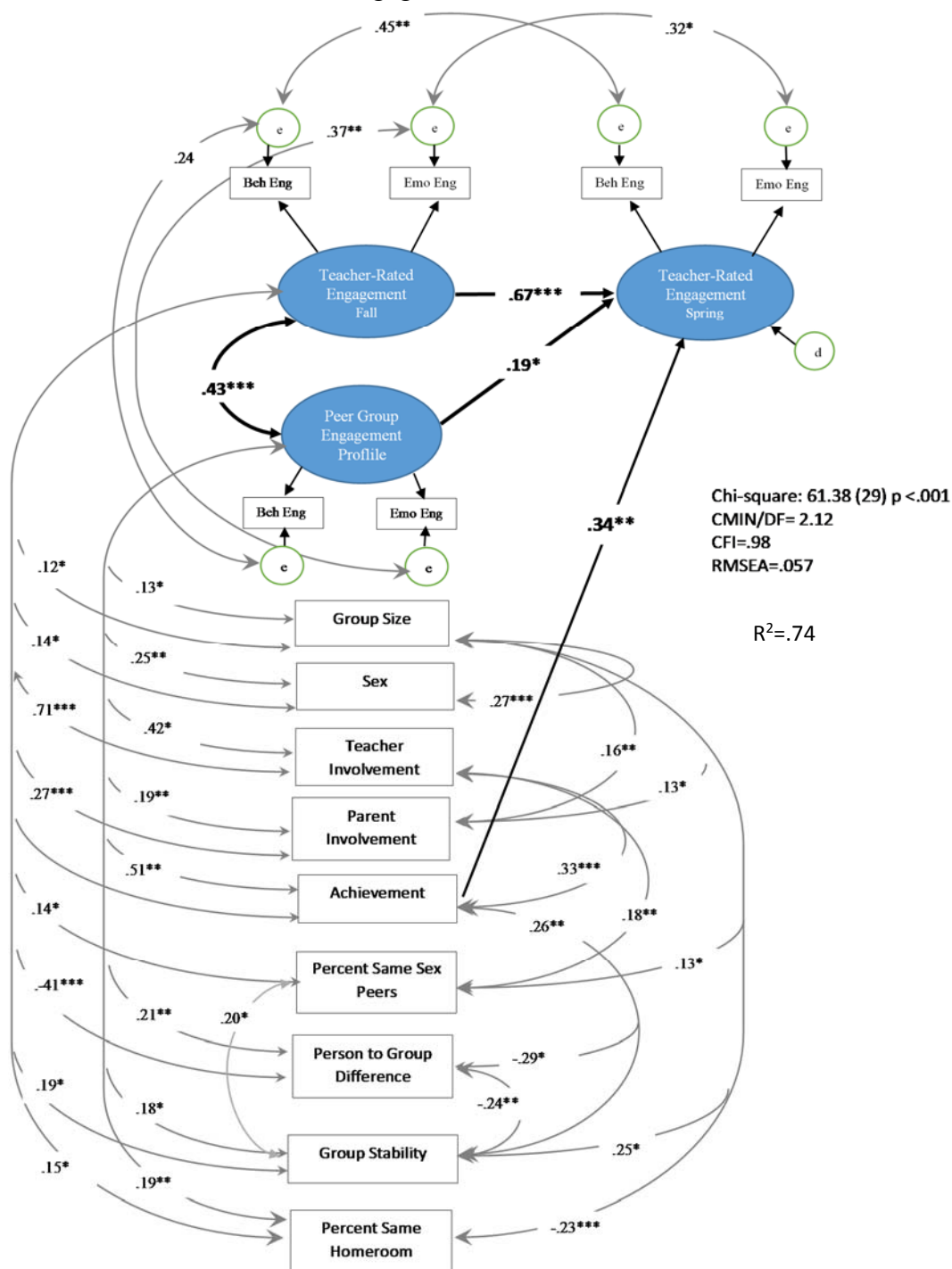
Figure 9: Simultaneous Regression Exploring Influence of Peer Group on Individual Engagement in Spring for Students with Non-Missing Networks



The core of the major analysis was to understand whether the hypothesized socialization effects of the peer network would be evident while controlling for selection effects, socialization effects from parents and teachers, as well as for the students' Fall individual engagement, therefore examining whether the peer group influences individual classroom engagement. Figure 10 provides the results of this analysis. The model indicated a reasonable fit to the data (chi-square=61.38, $p<.001$; CMIN/df=2.12; CFI=.98; RMSEA=.06), with peer group profiles appearing to significantly contribute to the development of engagement over the course of the academic year; firstly, beyond the contribution of individual engagement in the Fall; secondly, over and above variables that may be correlated with students' reasons for selecting peer group members; thirdly, over and above the influences from outside sources such as parents and teachers who may attempt to directly socialize the academic outcomes for students and finally, over and

above the homeroom in which the student was embedded. Apart from the peer group, the only other variable that contributed significantly to the development of academic engagement was the students' academic achievement in the Fall.

Figure 10: Peer Group Influence on Spring Engagement Controlling for Assortiveness Indicators and Fall Individual Engagement.



The model shows that while controlling for all other variables in the model, that as peer group engagement increases by one standard deviation in the Fall, Spring individual engagement increased by .19 of a standard deviation. Thus despite the decline in overall engagement from Fall to Spring shown in repeated measures analyses, the results of structural equation models provide evidence to suggest that being in a positively academically engaged network of peers may buffer a student's propensity towards school disaffection as their academic career progresses. And, academic ability also holds importance at this age when considering the development of engagement across an academic year.

In sum, there was evidence to support the hypothesis that student academic engagement in seventh grade can be predicted from peer group profiles of engagement, while controlling for variables that may be associated with reasons that students choose to associate with others, and while controlling for the influence of sources exterior to the peer network itself.

Summary. Two models were tested to assess whether individual peer engagement could be predicted based on the average engagement of the peers they hung out with. Controls were included to partial out variance that initial tests suggested could be related to the selection of peer group members. Both models provided evidence to suggest that the peer group in which an individual is embedded effects their later quality of engagement. Teacher involvement was only significantly predictive of later individual engagement when a control for individuals' earlier engagement was omitted. However,

both models suggested that academic achievement was important to later motivation. In each model achievement was significantly predictive of later individual engagement.

Chapter 9: Discussion

This longitudinal study was focused on 7th grade students over an academic year and found that the peer groups students chose to associate with influenced their academic outcomes. This study is important because it contributes to the growing evidence that peers group associations have consequences for long term school motivation. Several features of the study increase confidence in the findings presented. First, naturally formed peer groups were nominated by expert independent observers, and peer affiliates were only accepted if the likelihood of group membership was greater than could have been expected by chance. We can therefore have confidence that the groups nominated reflected the peers students frequently interacted with on a day-to-day basis. Second, this study controlled for the reasons that students may have selected to associate with different groups of students. This adds further weight to the finding that the academic development shown over this one year period occurred as a result of peer influence and was not because the processes due to selection were confused with development. Third, unlike many studies that have examined the effects peers have on fellow group members, this study used multiple sources of information thereby decreasing the possibility outcomes seen were inflated due to shared method variance. Forth, this study had true ecological validity which therefore increases the confidence of its generalizability to other students in other schools. And finally, this is an important study because in a ‘sea of research’ on peer influence, relatively few studies are focused on positive effects peers can have on one another. This study shows that peers influence each other in positive ways too.

This was a replication of previous research (Kindermann, 2007), investigating the roles of peers on students' academic development. The effects of a student's peers on their individual motivation, at this specific age, is important to understand because this is a period during which time with peers tends to increase, "psychological investment in peer relations" strengthens (Wentzel & Caldwell, 1999; p. 1199), there is an increased reliance on peers for social support and susceptibility to peer influence is beginning to peak.

The following discusses each of the findings in more depth, describes the strengths and limitations and finishes with a discussion of the directions for future research.

Peer Network Identification

The methodology used to identify networks in the Fall of seventh grade accounted for 94% of the student body with 78% of the cohort being found to have statistically significant ties with other network affiliates. This provides additional evidence for the utility of SCM methodology for identifying peer group affiliations. It should be noted that although approximately one quarter of the cohort had no statistically significant ties to other peers in the Fall of seventh grade this would not necessarily have meant they were friendless. Previous research has found that membership to a group is distinct from friendship, and although there is some overlap between network affiliations and friends, reciprocal friends are not always nominated to a network and individuals nominated to a network are not always nominated as a reciprocal friend (Kindermann, 2007, 2012; Wentzel & Caldwell, 1997); further, relationships are not always overtly obvious to

others. For example, young adolescents may prefer to keep some relationships hidden. The obvious type of relationship that comes to mind for this age group may be budding romantic relationships. Researchers have found that girls in particular are likely to keep early boyfriends a secret lest parents force an end to the relationship (Collins, Welsh & Furman, 2009). At younger ages peer groups tend to be almost exclusively segregated by sex but seventh grade is a time when they are becoming less gender segregated, and there is increased interest in opposite sex relationships as intersex platonic and/or romantic relationships start to blossom; it was therefore no surprise to find that 21% of the networks were mixed male and female even though the majority of networks were still comprised of same sex members.

In general, students tended to be relatively highly engaged with 42% of the students considered to be highly engaged and similarly affiliated with highly engaged networks. Also consistent with other research related to academic outcomes, girls tended to be more engaged than boys (Newton-Curtis, 2006; Meece, Glienke & Burg, 2006), and in more stable networks across the academic year (Kindermann, 2007); however, there was quite a high degree of network permeability with turnover approaching 51% across the academic year. Adolescents of this age, spend much of their day moving from classroom to classroom taking different classes with different peers. As a consequence it is not unreasonable to think that they would change peer affiliations to one degree or another across the period of a year, so what is particularly interesting is that despite the observed changes in peer group members, the motivational make-up of peer groups was sustained in steady state across the year ($r=.52$, $p<.001$); students maintained networks

exhibiting similar engagement profiles to those seen in the Fall. From a systems perspective this is not surprising since in order for there to be a major shift, a strong perturbation to the system would likely have been necessary. Within the school situation this perturbation might be possible, when appropriate, through what has been termed the invisible hand of the teacher. Farmer and colleagues (2011), describe teachers as being forces of influence that can help guide the social dynamics of a classroom toward a supportive atmosphere for students in which to attain optimum academic development. However, many teachers at this level are likely to put more direct focus on student performance rather than exerting leverage of influence toward shifting student network affiliations.

Student Perceptions of Parents and Teachers

Also consistent with prior research, students perceived their parents and teachers to be fairly highly involved with them. Females perceived parents to be more involved than did boys and more highly engaged students perceived more teacher and parent involvement. This is similar to results shown by Connell et al (1995) who found that engagement directly influenced the degree of perceived support from adults, with more engaged students perceiving more support. Similarly, others (cf. Hughes & Chen, 2011), have found that girls tend to experience more support from teachers than boys; this may be due in part to teachers finding it easier to interact with, and give support to children who are cooperative and compliant - a characteristic that is generally associated more with girls than with boys (cf. Hughes, Cavell & Willson, 2001).

Major Models

Because of its flexibility in handling both latent and observed variables while accounting for error and correlations among variables, and because of its ability to account for missing data using FIML, structural equation modeling was used to develop the two major models in order to assess whether Fall peer network engagement was predictive of individual Spring engagement while controlling for characteristics associated with selection into peer networks and the competing socializing influences of adults.

Model One. The results of the first model showed that, in concert with Kindermann's (2007) findings, students' peer networks were significantly uniquely predictive of later engagement even when variables that were associated with reasons for selection into a peer group were accounted for. The model also indicated that both achievement and teacher involvement contributed significantly to the prediction of later engagement. Once again, these findings replicated those seen when a similar model was applied to the cohort of students when they were in sixth grade. The model accounted for a large proportion (60%) of the variance in individual academic outcomes with much of it (54%) attributable to reasons for selecting into a group as well as from the effects of teachers and parents. The model also showed that as peer network engagement increased by a standard deviation individual academic engagement shown in the spring increased by a relatively large amount ($\beta=.27$).

Teachers. Teachers are important, and the initial model showed their impact on academic outcomes had a significant effect. It is important to remember that teacher

involvement in this context was measured by the student in terms of the warmth of the relationship with the teacher as well as by the student's perceptions that the teacher paid him/her adequate attention. This construct was grounded in the self-system model of motivation, in which relatedness (a warm connectivity) to important others is considered to be a fundamental psychological need that impacts energized action. A large body of research has been devoted to studies assessing the characteristics of teachers and their relationship to student academic outcomes and noted the importance of autonomy supportive warmth exhibited by a teacher to the development of a student's engagement and academic resilience.⁴ It may be that engaged students – being closer in alignment with the same academic values and goals held by teachers – may simply be more pleasant from the teacher's perspective to interact with, and therefore easier to provide consistent warm support to. If students are seen to enjoy their academic work and to be captivated by the topics and projects their teachers are interested in, students and teachers may act as attractors settling into a state space in which students are optimally supported. It is likely that teachers themselves may also be motivationally rewarded for their efforts with these types of students thus further cementing an affectively positive relationship that contributes to the increasing complexity of proximal processes within the student/teacher microsystem, thus leading to the development of increased academic skills and motivation for students: a virtuous cycle of interaction. Given the potential malleability of student engagement, this also emphasizes the importance of encouraging teachers to consciously put directed effort into maintaining a similarly affectively warm involvement with disaffected students, despite the inherent challenges involved in doing so, in order to

mitigate the formation of a vicious cycle of interaction that could lead to the cementing of relational negativity between student and teacher and potential academic disaffection for the student.

Academic achievement. Also contributing significantly to engagement at the end of the academic year was prior academic achievement. Studies on engagement and motivation typically explore the contribution of motivation to achievement with the obvious implication that more motivated students, all other things being equal, are likely to perform better in school. This model controlled for a baseline measure of achievement and found it to be a significant predictor of Spring student motivation. This finding is similar to those of other researchers who have found achievement to be related to positive school outcomes; for example, school social competence (Chen, Chang & He, 2003), and to have a moderating effect on the relationship between academic autonomy and behavioral engagement (Wang & Eccles, 2013). The notion that higher achievement is predictive of increased engagement is not counterintuitive – if a student does well in school this may result in him or her enjoying and being more interested in school related activities. And doing well holds particular weight at this juncture of a student’s life, when there is a change from elementary to middle school together with a concurrent change in school climate and when increased emphasis is placed on measures of academic performance.

Peer network effect. Most importantly, the initial model provided provisional evidence to suggest the likelihood of socialization of the student by peers, over and above that of interested adults and processes related to the selection of network members;

however, to truly establish whether the peer group influenced students' engagement over the course of time it was necessary to see if this relationship held over and above the students' own quality of engagement at the beginning of the school year.

Model Two. The second major model included students' earlier individual engagement as a control variable. As expected, this resulted in a large change (R-square change = .14) in the variance explained in Spring engagement over that shown in the initial major model. Importantly, even while taking earlier engagement into account the peer network was found to be influential to students' quality of engagement at the end of the school year. Post hoc analyses showed that the addition of network profiles of engagement to a model that included the selection variables, parent and teacher variables and Fall individual engagement added a further 3% of the variance to individual engagement at the end of the academic year. Of primary importance, the model provided evidence to underline the importance of the peer network to later student motivation in a longitudinal study in which the teachers' and parents' socialization influences were accounted for, and while accounting for the processes of selection into peer networks. While the amount of additional variance explained by the peer network influence was not large over the course of a student's academic career it is expected that network effects would cumulate.

Worthy of note is that when earlier measures of individual engagement were accounted for, the impact of the teacher was no longer found to be significant. This is contrary to findings from previous work (Kindermann, 2007). It is likely that with young adolescents' increasing maturation, teachers may increasingly have differing degrees of

influence that depend on a student's initial engagement. This was not explored in the current study. Also contrary to work shown by Kindermann, (2007), achievement remained predictive of student engagement for 7th grade students. This most likely reflects the increased focus on performance that is expected from students as they progress through middle and high school.

Selection vs. Socialization

In order to truly establish that the peer group influenced individual student engagement it was necessary to disentangle socialization from selection. While the variables chosen to control for selection into networks could be considered rather limited, the motivational characteristics of networks tended to be remain relatively stable despite an average membership turnover of about fifty percent. This replicates the findings of other studies in which quality of network engagement is maintained despite turnover in network members (e.g. Kindermann, 2000; 2007), and suggests a process of students selecting new peers with similar motivational characteristics when new members are added or replaced. This is not to say that motivation is something that students directly base new network member selection upon. It is likely that engagement may be consequence of selecting members based on other correlating characteristics. Remember, for example that in this study girls tended to be more motivated than boys and that networks tended to be comprised mainly of same-sex members. Further, the similarity of peer network members' engagement could be a by-product of other correlating unmeasured third-variable reasons. For example, in examining the raw peer nominations data, nominators also provided names and descriptions for the peer network nominees,

such as “plays sports together,” “cool kids,” “smart kids,” suggesting that these youth hung out together because of those similar interests. It is possible that the tangential attributes that brought together groups of students because they liked sports, or because they were ‘cool,’ or ‘smart’ might also be associated with the quality of academic engagement individuals held as well.

And although ‘good’ parenting and ‘good’ teaching calls for directed efforts towards academic socialization, it is similarly possible that students simply felt more comfortable in the company of other students who experienced comparable home environments or whose parents held similar values (regardless of what those environments or values may be), correspondingly students may have selected to affiliate with each other based on the similarity of their attitudes, positive or negative, about a certain teacher. In other words, it could be that similarity on collateral criteria to those posited as selection criteria tends to result in peer groups that display similarity in quality of engagement too.

Strengths and Limitations

A series of strengths and limitations are found in the current study. These are first discussed as they relate to the bio-ecological model. This is followed by a discussion focused on the degree of data missingness, and lastly some thoughts about suppression in the major models.

The bio-ecological model. As previously described, Bronfenbrenner & Morris (1998), proposed that four distinct components should be considered when exploring individual development, 1) the distinguishing features the person brings to the situation

based on their individual characteristics and prior history, 2) the process – or mechanism by which development occurs, 3) the context in which development occurs, and 4) the time period during which development occurs. These four components work synergistically together to produce individual development over time. This study took all four components into consideration; and in all four areas there were strengths and limitations regarding the extent to which they were considered.

Person. The primary focus of the study was to assess whether individuals' peer networks could predict quality of engagement over time taking individual characteristics of the person into consideration. According to Bronfenbrenner three types of within-person characteristics work to initiate the proximal processes that drive development. These characteristics will affect whether interactions are sustained, halted or even prevented from occurring at all. The within-person characteristics he describes can be categorized as three complementary types: force, resource and demand. The following paragraphs describe the applications of each of these within the current model, highlighting the strengths and limitations of their use.

Force characteristics. Force characteristics refer to developmentally “generative” or “disruptive” features of the individual (Bronfenbrenner & Morris, 1998, p.810). In this study, at the person level, the force characteristic of engagement/disaffection was a focal point of interest due to the importance it holds for an individual's academic adjustment. It was also treated as the feature helping to drive the increasing complexity of proximal processes between the individual and his/her network contributing to individual development. As noted, on average - engaged students tended to hang out with other

engaged students and less engaged students tended to hang out with other less engaged students. While there was no doubt large overlap as well as some differences in the focus of the conversations and interactions among the groups of students regardless of their quality of engagement, it is possible that the emerging complexity of those interactions differed in quality when comparing highly engaged students embedded in highly engaged networks with less engaged students embedded within less engaged groups. This would contribute to the “Mathew effect” (cf. Rigney, 2010), supported by the model in this study, and describing a propensity for those who start off as academically engaged, and aligned with academically engaged groups, to accumulate an academic advantage over those less engaged students whose reciprocal interactions occur primarily within networks of students who are similarly less engaged. It is important to remember however that engagement was the only within-person force characteristic taken into account, which represents a potential limitation.

Resource characteristics. Resource characteristics refer to bio-psychological aspects of the individual that limit or allow for increased complexity of proximal processes. According to Bronfenbrenner these can include features such as abilities/disabilities and/or experiences the person brings to the proximal processes. Two resource characteristics were taken into account in this study. The average of achievement, taken in the Spring of 6th grade and Fall of 7th grade, was considered a proxy for ability. It is widely agreed that achievement is not always directly reflective of ability; however, in seventh grade achievement is important and was thus used as a variable that was expected to affect the types and complexity of the individual’s proximal

processes with network members as well as with teachers and parents. The sex of the student was another resource characteristic that was expected to affect the type of proximal processes. As described previously, on a bivariate level, sex was related to the perceptions the individual had about the degree of their parents' involvement, the network of peers the individual was associated with as well as its size, and therefore with whom the interactions would occur, and the quality of engagement exhibited.

Demand characteristics. It should be noted that individual demand characteristics were not taken into account in the aforementioned model. These are the types of characteristics that evoke reactions from the environment and that Allport (cf. Bronfenbrenner & Morris, 1998), referred to as being a part of the person's personality. For example it is possible that someone with a very shy personality could be in a relatively large group but the proximal processes involved would be qualitatively different and/or less frequent than those of a person who was extroverted within the same group. In other words the degree to which the network had a greater or lesser influence on an individual based on that individual's demand characteristics was not taken into account in the preceding model.

In sum, while perhaps limited, an overall strength of the model is that both force and resource characteristics were taken into account; however, future studies may also want to explore the contribution of the individuals' respective demand characteristics in order to better understand how these may serve to dampen or heighten influences of the peer network on student engagement outcomes.

Process. Since this study was grounded in Bronfenbrenner's bio-ecological approach, it was anticipated that the microtime proximal processes of interaction between each student within their respective peer network would be a driver of the person's developmental trajectory over time. Other research has suggested that mechanisms underlying developmental intra-individual-change can include for example contingent responses (Sage et al, 2002; Sage & Kindermann, 1999) mutual assistance and modeling (cf. Wentzel & Cladwell, 1997), acceptance of group norms (Salmivalli & Voeten, 2004), and social comparison. It is expected that these mechanisms may be the reasons for observed development in the current study; however, a limitation of this study is that it did not directly explore the *mechanisms* by which the proximal processes were driving development in this context.

Context. The context of the individuals' developmental trajectory was explored in terms of the unique peer networks while also accounting for the context of teachers and parents. The following section describes the strengths and limitations of the methodology used to account for the context of students' motivational development as well as the parent and teacher context.

Sample. Most studies of peers and peer influence are based on samples drawn from one, or perhaps several classrooms, within one participating school in a city. A major strength of the current study is that this school was the only school system in the town and therefore study participants were comprised of virtually all children and youth living in the town. As a result, the peer groups that were identified likely represent the true extent of the each student's respective network of peers. In other words this study

had true ecological validity⁵. So, whether youth were ‘hanging out’ together in school, doing extra curricula activities, out at recess, or even at the mall – this information was likely to be captured by the methodology used. A limitation however is that the location was a fairly small rural town with little variation in social class or ethnicity. This may call generalizability into question. For example, much has been written about an oppositional culture amongst African American students – that academically motivated black students may be taunted by their peers for “acting white.” Studies – both quantitative and qualitative – have delineated the complexity of this issue; that is, when, for whom, and in what contexts this may occur (e.g. Downey & Ainsworth-Darnell, 2002; Bergin & Cooks, 2002; Fordham & Ogbu, 1986). Additionally, several researchers have found that teacher support may be more important for African American students than for European American students (cf. Wang & Eccles, 2013), both of these factors could impact the generalizability of this study. Other ethnic perspectives that should also be explored are differences between collectivistic cultures and individualistic cultures; students embedded within an individualistic culture may be motivated for their own individualistic reasons whereas those in collectivistic cultures may be motivated because of a drive to meet the expectations of others – this could potentially affect motives for selection into a group as well as the degree of influence the group has on the individual (Chen et al, 2003) as upward and downward social comparisons are made that could influence both motivation and achievement Altermatt & Pomerantz (2005). The above suggests that it could be useful to replicate this work with a more heterogeneous sample of students so that generalizability of the model to other cultures can be actively assessed.

Methods. The Socio Cognitive Mapping method used identified peer groups that were highly reliable in terms of linkage identification amongst individuals due to the number of nominators for each group. And because of the identification of publicly known groups that this method calls upon, network accounts were given that were inclusive of children who were unavailable during the time of assessment or were non-participants. Thus, this methodology ensured that a higher level of student inclusion was reliably attained than could have been possible using other methods. One weakness of this method however is that it relies purely on participants' *observations* of interactions. It is possible that peer influences that are not readily captured by this method have some influence on academic motivation. An example of this is the widespread electronic contact that youth tend to have with each other. It is entirely possible that children who are not *publicly* affiliated may be in regular electronic contact through texting, social network sites, online chat, online video games, e-mail and so forth. In a review of the literature Subrahmanyam and Greenfield (2008) found that electronic communication may be making adolescents less interested in face-to-face communication; one report suggests that girls in the USA between the ages of 12-17, average 4,050 texts per month and boys of the same age average 2,539 (cf. Garcia, Hardeman, Kwon, Lando-King, Zhang, Genis, Brady & Kinder, 2014). These methods of communication have become ubiquitous in the past several years. Future studies may need to use SCM in association with a method that can capture electronic association to fully understand network affiliation influences on development.

In addition this study only took into account the context of peers who were directly connected to the actor, but we know these youth are not the only ones to influence an individual's development over time. For example, Sage & Kindermann (1999), found that to some degree regardless of peer network affiliation, off-task antics in a classroom were actively enjoyed and approved of by most of those around; however, there was a weak tendency for less motivated students to receive *disapproval* from non-peer-group members for their off-task behavior. In both regards, these contingencies are likely to contribute to development – for better or worse. As another example of students who may not be direct peer affiliates having influence on development, Skues, Cunningham & Pokharel (2005), perhaps unsurprisingly, found that students who were bullied at school (one assumes by non-network affiliates), felt less connection with school and others at school, and were also less academically motivated. It is also possible that students with whom the 'actor' has an emotional connection (whether this is positive or negative) within the peer group may have more influence than those with whom he/she merely "rubs shoulders with;" this should be explored in future studies.

Parents and teachers. Finally, a strength of the study is that the context of parents and teachers was taken into account. It was important to understand these contexts from the perspective of the students themselves rather than from objective accounts of 'reality' because it was theorized that these *perceptions* would contribute to being selected and selecting into groups as well as being direct contributors to development of individuals' engagement.

This study therefore took into account the three major contexts of a youth's life: peers, teacher and parent in attempting to understand the influences on academic motivation.

Time. Finally, a strength of this study lay in the fact that it was longitudinal nature. In the absence of a randomized controlled trial, by using a longitudinal design one can place more confidence in the outcome being a result of development. However, there were only two time-points assessed in the current study. Motivation, despite its malleability, may be a relatively stable attribute for most youth, so it would not be reasonable to expect dramatic changes in motivation over an academic year for most children unless there is a major perturbation in the child's world. Even in these circumstances perturbations may be more likely to cause downward shifts in motivation rather than upward as the most common major perturbations students experience are likely to be negative events such as parental divorce or major illness in the family. For most, shifts in motivation are more likely to occur at a gradual pace and accumulate in a snowballing positive or negative way across a child's entire academic career. Longitudinal studies across the entire Kindergarten through Grade 12 sequence would be necessary to fully understand leverage points in the peer system during which interventions might be more effective.

Missing Data

One point that demands attention is the degree of data-missingness. Appendix A shows that out of the 15 variables used in the model only one had complete data; five variables had 20 to 30 percent of data missing and one variable was missing nearly 60%

of its data (exact percentages of missing data together with patterns of missing data can also be found in Appendix A). However, a further inspection revealed that relatively little of the data collected in the Fall term were missing. In other words a high proportion of parent and teacher involvement data that were supplied by students were complete or very close to complete, and Fall student engagement data supplied by teachers were also relatively complete. Conversely, a substantial proportion of Spring engagement data were missing; this is likely related to teachers' lack of time to devote to survey completion during the very busy end-of-year period rather than to a systematic relationship between missingness and the individual students' degree of engagement in the Fall or Spring. Similarly, since teachers provided information regarding students' engagement, it is unlikely that there was a systematic association between a student's lack of network information and his/her individual degree of engagement in the Fall or Spring. Further, data that are missing in monotonic patterns are likely present less of a challenge, and are less problematic, than other patterns of missing data (Roderick, Little & Rubin, 1986). As described previously, data were most likely not MCAR, but imputation was conducted based on the impossible-to-test assumption that data were MAR and that as a consequence parameter estimates are likely to be unbiased.

Suppression

A further consideration to take into account when considering the results of the analyses is that of suppression; when individual and network engagement in Fall were entered into a pairwise simultaneous regression model for those youth identified as having a network, the standardized beta weight for the influence of the peer network on

individual engagement in the Spring was relatively small ($\beta=.07, p < .05$)⁶, whereas in the full SEM model the contribution of the peer group to later engagement appears, on the face of it, to be somewhat larger in magnitude. There is a long history of research documenting an evolving understanding of suppression and the effects it can have on analyses, dating back as far as 1939 when Mendershausen referred to suppressors as ‘clearing variables,’ (cf. Ludlow & Klein, 2014). Horst (1966 p. 363), further explained that “a suppressor variable may be defined as those predictor variables which do not measure variance in the criterion measures, but which do measure some of the variance in the predictor measures which is not found in the criterion measure. They measure invalid variance in the predictor measures and serve to suppress this invalid variance.” A broader view of a suppressor was supplied by Cohen and Cohen (cf. Paulhus, Robins, Trzesniewski & Tracy, 2004) who suggested that a suppressor is simply a variable that increases the weight of a predictor already in the model.

There is evidence of suppression in the core model, with control variables acting synergistically to increase the predictive nature of the peer network on later engagement; the teacher’s involvement as well as the individual’s achievement seem particularly important to the synergistic mechanisms of suppression. (see Appendix D). One interpretation of this is that the addition of these variables into the model allowed for the *unmasking* of the effects of the network on the individual in Spring.

Future Directions

This study specifically focused on influences of social networks as a context for individuals’ development of engagement over time. As previously described, traditionally

there have been several threads of research exploring the influence of peer relations on child and youth development; and researchers within each of these threads have tended to work within their own relatively independent silos, using independent methods of peer identification and conceptualization to describe and explain how development unfolds (Gifford-Smith & Brownell, 2003). In order to fully understand the complexity of peer effects on individual development the integration of these research threads is long overdue and should be more fully explored.

Tensegrity. An integration of the words tension and integrity to describe an entity that has flexibility while maintaining strength in response to environmental pressure, and in line with a system's approach, Kindermann and Skinner (2012), took "tensegrity" as a metaphor to understand the complex nature of the peer domain and the balancing forces at play between the 'skeleton' and 'muscles' of the peer world; this in order to help conceptualize how parts and wholes might interrelate as well as a way to help think about the different forces that may be involved within peer structures of networks and friends and how they may work interactively together. Tensegrity as a metaphor would suggest that in the same way that a human has a skeleton to provide structure, and muscles which allow the body to show flexibility, some peer relationships may act as a skeleton - being more important for holding the peer structure together, while other relationships may be comparable to muscles in that they allow for flexibility of the peer structure. This metaphor may be useful as a guiding framework for the exploration of other overlapping peer constellations including those of sociometric status and crowd association - and in the ways they interact with friendships and networks on differing types of academic

outcomes. The tensegrity metaphor provides an additional conceptual framework from which to explore differing combinations of peer groupings in terms of both their structure and function, and may help bring together in a cohesive way, the research that has been conducted in the past based on the differing methodologies researchers have used. Lastly, it seems that more emphasis should be placed on where, in terms of engagement, the youth falls within these peer groupings. It may be that individual engagement develops differently depending upon how closely the student's own engagement is aligned with that of their peer context. For example, Altermatt and Pomerantz (2005), found that, contrary to typically held beliefs, association with high performing classmates is not always beneficial for all children because social comparisons between peers can lead to deficits in self-evaluative beliefs in the short-term despite improved grades in the long-term (see Appendix C for simple t-tests showing trend lines for the change over time in engagement for students and peer groups categorized as high and low in engagement).

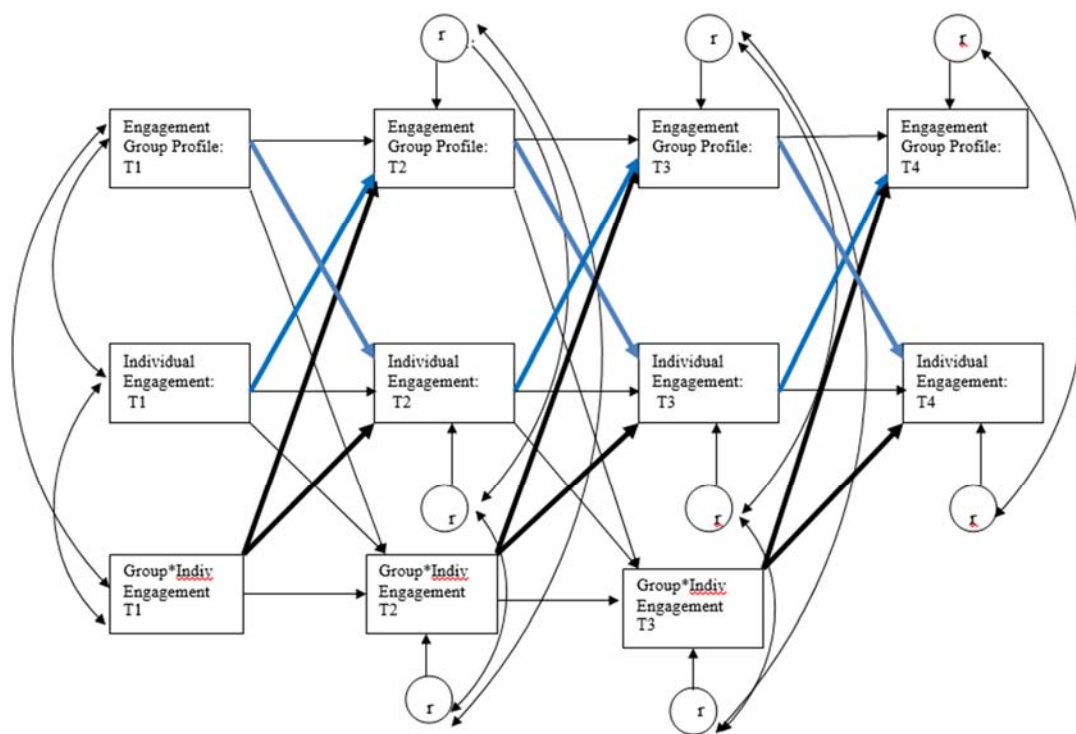
Electronic Communication. Of primary importance, it is clear that future research in the area of peer network influence must attempt to understand peer networks that are maintained through electronic means, thus taking peer socialization through electronic proximal processes into account. A recent study conducted by the Pew Research Center (Lenhart, 2015), found that approximately 88% of American teens aged 13 to 17 had access to a cell phone which they use to connect with others and go online. Nevertheless, capturing student electronic interactions may be difficult. In order to explore these activities creative methods will be needed; while some electronic activity may be obtainable by researchers through publicly accessible avenues, the collection of

other information, texting for example, may have to pragmatically rely on participants' self-report – perhaps in a way akin to the methodology typically used in friendship studies. Whatever method is used it will be necessary to thoroughly engage youth themselves in understanding what may, or may not be achievable, as well as the specific electronic mechanism that would be appropriate to consider based on the area of study.

Socialization and selection. Further studies might also be aimed at examining the simultaneous contributions of group-to-individual socialization and individual-to-group selection, and these effects on individual engagement over time. This could be achieved across multiple years. Doing so would be important because the strength of contributions of socialization and selection may differ over the course of a student's academic career opening the door to leverage points in the trajectory of development that might otherwise be missed. One way to do this would be to use a model similar to the one shown in Figure 11 below, based on Cook & Kenny's (2005) description of an actor-partner independence model. In this model it can be seen that controls are placed to account for the amount that current engagement at each time point predicts later engagement at both the individual and network levels. Importantly this model also takes into account the influence of the group on the individual – which would imply socialization – as well as the influence of the individual on the group – implying selection. Including interaction terms would provide an ability to assess whether socialization and selection occurs differently for engaged/disaffected students in engaged/disaffected groups. In this model, by constraining parameters to be equal and by using chi-square difference tests it would be possible to ascertain the differential weights of influence at different time points

indicating socialization or selection. This model has been recommended for studies of small groups and versions of this model have been used to study for example, the relationship between individual alcohol use and peer alcohol use (Curran, P.J., Stice, E & Chassin, (1997) as well as the reciprocal effects of student-teacher and student-peer relatedness and their effects on self-efficacy (Hughes & Chen, 2011).

Figure 11. Cross Lagged Model with Interaction Terms Across 4 Time Points



Implications for Education

The overwhelming evidence from a variety of studies is that peers have an effect on individual development for both good and bad.

The invisible hand of the teacher. Gronlund in the late 1950s made the point that teachers should be explicitly trained in sociometry as a way to understand student

behavior (cf. Kindermann, 2011), and well prior to Gronlund's recommendations, Moreno in his work to understand the state of runaway girls in upstate New York during the 1930s highlighted the benefits of sociometry for understanding behavior. Further supporting the benefits of understanding peer social dynamics, Hamm, Farmer, Dadisman, Gravelle & Murray (2011) in a randomized controlled trial, found that when teachers were trained in this type of knowledge and were attuned to peer social dynamics, their students felt more supported, and had a more positive view of the school than students of teachers with no training. This appeared to be especially important across the transition from elementary to middle school – a time of peer reorganization as feeder schools funnel students to the typically more bureaucratic and the often emotionally colder climate of middle school, and when multiple studies have shown student declines in motivation (Hamm et al., 2011). The 'invisible hand of the teacher' was further highlighted in an experimental study where student seating was rearranged to group 5th and 6th grade students who disliked each other in closer proximity to each other. Likeability ratings increased and victimization decreased (van den Berg, 2012).

A concrete anecdote is related about one teacher who had a background in sociometry (Kindermann, 2011). This teacher would take systematic periodic note of the peer dynamics within his classroom and noticed that a student who formally had been socially well positioned had been edged to the classroom periphery. This teacher made the decision to purposefully reposition seating arrangements so that the student was now in a centrally located seat and was assigned tasks that would promote other students to interact with her. The change was a success for the student, increasing her social status as

well as helping her to build and rebuild connections with other students. No doubt the teacher also felt a warm sense of achievement himself at this success. However, the reality is, most teachers know little about sociometry and in upper level schools may pay little deliberate attention to student social interactions and affiliations (except for those that might disrupt classroom instruction), despite the effects they may have on motivation and learning. It is important to recognize the large role teachers play in the way peers' affiliations are configured within the school environment – both in their deliberate concrete actions through the way they organize and structure classrooms, arrange work-groups and seating arrangements and in the more subtle ways they may unknowingly influence peer associations as a byproduct of the relationships they themselves hold with students.

The school environment, at least for nine months of the year, takes up the majority of both students' and teachers' lives. They interact with each other on a daily, hour by hour, minute by minute basis – in classrooms, in hallways, in lunchrooms – as teachers and students arrive in the morning and as they leave in the afternoon. And, to repeat, the proximal processes occurring between individuals within one system are likely to directly, and/or indirectly affect, promote or discourage those in another system. In the school context this suggests that the quality of interactions a student has with a teacher is likely to affect the relationships that same student may have with his or her peers. While the hallmark of a peer group is that it tends to be self-selected, teachers may unknowingly influence the permeability of peer network boundaries with regard to which students are allowed entry and which are not, through the relationships teachers themselves hold with

individual students. For example, students may see a teacher talking with another student, and through the emotional tenor shown by the teacher in those exchanges over time, that same student may become more or less likeable to other students as they develop reputations based on those interactions (Hughes & Chen, 2011). Following on from this it seems that students who are well liked would find boundaries to more motivationally adaptive peer networks to be more permeable than students who were less well liked or disliked entirely. Students may find it more or less easy to form friendships with certain students – also based on those reputations. And, although the magnitude of effects are small, research has correspondingly found that the quality of teacher-student relations has an effect on the way peers relate to and interact with each other in the classroom, be it cooperatively, prosocially or aggressively, with emotional support specifically important to later prosocial behavior amongst students (Luckner & Pianta, 2011). However, many teachers are unsure of the degree to which they should or should not develop relationships with students. On the one hand some think they are not obliged to meet student relational needs while others believe that doing so might negatively impact student academic outcomes (cf. Hughes & Chen, 2011); this despite the wealth of studies to the contrary!

Following on from this it seems that teachers must understand how their own behaviors and emotions affect student interactions *and* should develop some degree of expertise in sociometry in their professional toolbox to help remedy maladaptive student situations and behaviors. In sum, there is a need for methods to improve teacher knowledge and use of sociometrics in their day to day activities, and to understand the

impact their relationships with students have for student relationships with each other: teachers need to understand more fully “the invisible hand of the teacher,” (Hamm et al, 2011; Hughes & Chen, 2011; Kindermann, 2011). Clearly, more development and testing of teacher-focused interventions and ‘refreshers’ are needed for those teachers already in-service, and graduate schools of education must pay attention to helping future teachers gain knowledge and expertise in both of these areas in order to be maximally effective in their future professional lives, and most importantly for the benefit of students.

Contribution to the Field

This study provided additional evidence to underscore the importance of taking into account the influence of peer network members on individual academic development in early adolescence. While the influence may be small it is nonetheless important due to the snowballing effect it is likely to have across an academic career. This study supports the findings by Kindermann (2007), suggesting that ‘who hangs out with whom’ is important to understand and must therefore be taken seriously by teaching professionals as a factor to pay attention to in their academic endeavors with students. In the past few years there has been increasing research focused on the neuropsychological aspects of adolescents’ brain development (cf. Steinberg, 2010). It has been found that approval from peers is particularly salient to the adolescent brain and that when adolescents are with their peers they are “more likely to pursue rewards..... and there is no reason why these rewards should not be academic rewards,” (cf. Sparks, 2013).

Footnotes

1. While intrinsic motivation assumes a locus of causality that is purely internal, Ryan and Deci (2000), suggest that extrinsic motivation can be broken into subtypes whereby, the 'locus of causality' will range from entirely external to somewhat internal, and internal. Associated behavioral regulatory processes will consequently range from those that are based purely in external reward and punishment contingencies to those where there is an associated internalization of value placed on the behavior. Thus while the behavior may not be intrinsically motivated it may be more, or less, autonomous in nature.
2. It was expected that there could be cases with low expected cell frequencies therefore Fisher's Exact was used in addition to z-scores to identify significant connections (von Eye, 1990).
3. Individual and peer network errors were correlated firstly because the items used to construct the behavioral engagement and emotional engagement constructs were the same and secondly to account for teacher biases; these would not be (easily) influenced by students' social interactions with their peer group.
4. It should also be noted that the energized activity of an engaged student (as described by the self-system model) has many similarities with the attributes Dweck (2006) describes regarding students who have a 'growth mindset,' that they embrace challenges and persist in the face of setbacks.
5. A major critique that Bronfenbrenner made was that "much of contemporary developmental psychology is the science of the strange behavior of children in

strange situations with strange adults for the briefest possible periods of time.”

(Bronfenbrenner, 1977, p 513). In other words, the results of many developmental studies are lacking ecological validity because they are derived from designs that place children in contrived situations.

6. The Normal P-P plot indicated that there was slight deviation from normality therefore simple bootstrapping (1000 samples) was run. This indicated that the unique contribution for peer network influence on later individual engagement while controlling for individual Fall engagement was significant ($\beta=.07$, $p < .05$, 95% CI [.007, .154]).

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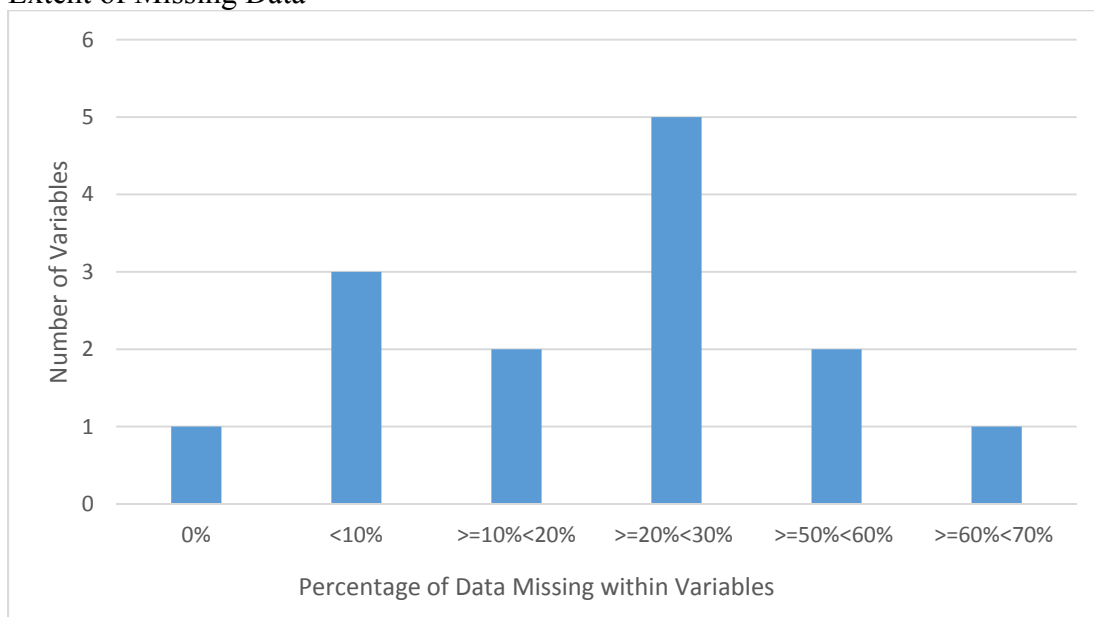
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Appendix A: Missing Data

1. Extent of Missing Data
2. Means and Standard Deviations (pre-imputation) Together with Percentage of Missing Data for each Variable
3. Patterns of Missing Data

Extent of Missing Data



Means and Standard Deviations (pre-imputation) Together with Percentage of Missing Data for each Variable

	M	SD	N	N-Missing	Percent Missing
Fall Behavior Engagement	3.03	.73	315	28	8.2
Fall Emotion Engagement	3.43	.50	304	39	11.4
Spring Behavior Engagement	2.75	.73	149	194	56.6
Spring Emotion Engagement	3.19	.46	169	174	50.7
Fall Network Behavior Engagement	3.08	.51	259	84	24.5
Fall Network Emotion Engagement	3.44	.38	259	84	24.5
Fall Teacher Involvement	3.10	.48	304	39	11.4
Fall Parent Involvement	3.03	.72	310	33	9.6
Network: Percent Same Sex	.92	.19	262	81	23.6
Spring 6 th Grade/Fall 7 th Grade Individual Achievement	8.47	2.12	133	210	61.2
Person to Group Difference in Engagement	.43	.35	241	102	29.7
Sex	.48	.50	343	0	.0
Network: Percent in Same Class	.36	.33	245	98	28.6
Network Size	5.29	5.03	327	16	4.7

Patterns of Missing Data

#of Cases	Sex	<u>Missing Patterns</u>													Complete if		
		Network Size	Fall Beh Eng	Fall Emo Eng	T-Involve	P-Involve	Network: % same sex	Network Emotion Engage	Network Behavior Person to Network Diffis	Same Class %	% Kept Fall to Spring	Spring Behavior	Spring Emotion Engage	Achievement			
35																	35
40																X	75
5						X										X	81
8														X			43
5														X		X	88
22														X	X	X	82
15															X	X	52
23															X	X	118
40															X	X	193
4						X									X	X	87
4															X	X	209
5															X	X	90
12							X	X	X	X	X	X				X	119
8							X	X	X	X	X	X					54
5							X	X	X	X	X	X	X			X	133
9							X	X	X	X	X	X	X	X		X	261
7							X	X	X	X	X	X	X	X			107
4		X					X	X	X	X	X	X	X			X	126

Variables are sorted on missing patterns. The first row in the table represents the pattern for 35 cases that have blanks for all 15 variables; there is no missing data. For 40 cases only achievement is missing, for five cases both achievement and parent-involvement is missing, and so on. The column labeled “Complete if..” represents the number of cases that would be complete if that variable (marked X) were not used.

Appendix B: Estimates and Covariances, Models 1 and 2

1. Major Model 1: All Unstandardized and Standardized Estimates
2. Major Model 1: All Covariances and Correlations
3. Major Model 2: All Unstandardized and Standardized Estimates
4. Major Model 2: All Covariances and Correlations

Major Model 1: Unstandardized and Standardized Estimates

			B	S.E.	C.R.	P	β
Student Engagement Fall	<---	Peer Group Engagement Profile Fall	.318	.135	2.356	.018	.265
Student Engagement Fall	<---	Group Stability	-.074	.210	-.351	.725	-.037
Student Engagement Fall	<---	Person To Group Difference	.108	.159	.679	.497	.064
Student Engagement Fall	<---	Achievement	.154	.031	5.051	***	.561
Student Engagement Fall	<---	Fall Parent Involve	.068	.064	1.052	.293	.083
Student Engagement Fall	<---	Network Size	.008	.009	.827	.408	.066
Student Engagement Fall	<---	Percent Same Sex Peers	-.042	.258	-.161	.872	-.014
Student Engagement Fall	<---	sex	.156	.103	1.515	.130	.131
Student Engagement Fall	<---	Percent in Same Class	.070	.166	.421	.674	.039
Student Engagement Fall	<---	Fall Teacher Involve	.240	.114	2.110	.035	.196
Fall Network Beh Eng	<---	Peer Group Engagement Fall	1.000				.954
Fall Network Emo Eng	<---	Peer Group Engagement Fall	.671	.046	14.704	***	.888
Spring Behavioral Engagement	<---	Individual Engagement Spring	1.000				.836
Spring Emo Eng	<---	Individual Engagement Spring	.629	.070	8.984	***	.826

Major Model 1: Covariances and Correlations

			Variance	S.E.	C.R.	p	r
Achievement	<-->	Peer Group Engagement Profile Fall	-.008	.093	-.088	.930	-.008
Person To Group Difference	<-->	Peer Group Engagement Profile Fall	-.033	.012	-2.805	.005	-.189
Group Stability	<-->	Peer Group Engagement Profile Fall	.030	.013	2.405	.016	.203
Fall Parent Involve	<-->	Peer Group Engagement Profile Fall	.071	.024	2.977	.003	.198
Network Size	<-->	Peer Group Engagement Profile Fall	.333	.157	2.114	.035	.134
Percent Same Sex Peers	<-->	Peer Group Engagement Profile Fall	.010	.006	1.651	.099	.107
sex	<-->	Peer Group Engagement Profile Fall	.069	.016	4.332	***	.280
Same Class Percent	<-->	Peer Group Engagement Profile Fall	.028	.011	2.539	.011	.172
atinv7	<-->	Peer Group Engagement Profile Fall	.095	.017	5.735	***	.395
Person To Group Difference	<-->	Achievement	-.240	.067	-3.596	***	-.318
Group Stability	<-->	Achievement	.181	.070	2.595	.009	.280
Achievement	<-->	Fall Parent Involve	.217	.126	1.723	.085	.139
Achievement	<-->	Network Size	1.152	.853	1.351	.177	.106
Achievement	<-->	Percent Same Sex Peers	.038	.036	1.057	.291	.090
Achievement	<-->	sex	.123	.084	1.471	.141	.114
Achievement	<-->	Same Class Percent	.087	.062	1.410	.159	.123
Achievement	<-->	atinv7	.322	.086	3.755	***	.308
Group Stability	<-->	Person To Group Difference	-.025	.009	-2.786	.005	-.234
Person To Group Difference	<-->	Fall Parent Involve	-.018	.017	-1.101	.271	-.073
Person To Group Difference	<-->	Network Size	-.292	.113	-2.584	.010	-.166
Person To Group Difference	<-->	Percent Same Sex Peers	.000	.004	.044	.965	.003

Major Model 1: Covariances and Correlations

			Variance	S.E.	C.R.	p	r
Person To Group Difference	<-->	sex	-.006	.011	-5.53	.580	-.035
Person To Group Difference	<-->	Same Class Percent	-.004	.008	-4.82	.630	-.032
Person To Group Difference	<-->	atinv7	-.034	.011	-3.062	.002	-.201
Group Stability	<-->	Fall Parent Involve	.030	.018	1.669	.095	.138
Group Stability	<-->	Network Size	-.051	.119	-4.28	.669	-.034
Group Stability	<-->	Percent Same Sex Peers	.012	.005	2.473	.013	.202
Group Stability	<-->	sex	.038	.012	3.187	.001	.256
Group Stability	<-->	Same Class Percent	-.012	.008	-1.482	.138	-.121
Group Stability	<-->	atinv7	.020	.012	1.661	.097	.136
Fall Parent Involve	<-->	Network Size	.611	.213	2.863	.004	.168
Fall Parent Involve	<-->	Percent Same Sex Peers	-.009	.009	-1.007	.314	-.065
Fall Parent Involve	<-->	sex	.047	.021	2.288	.022	.131
Fall Parent Involve	<-->	Same Class Percent	-.014	.016	-.924	.355	-.061
Fall Parent Involve	<-->	atinv7	.030	.021	1.448	.148	.086
Network Size	<-->	Percent Same Sex Peers	.006	.060	.093	.926	.006
Network Size	<-->	sex	.674	.144	4.697	***	.268
Network Size	<-->	Same Class Percent	-.001	.104	-.009	.993	-.001
Network Size	<-->	atinv7	.007	.141	.050	.960	.003
Percent Same Sex Peers	<-->	sex	.012	.006	2.023	.043	.125
Percent Same Sex Peers	<-->	Same Class Percent	.004	.004	1.050	.294	.068
Percent Same Sex Peers	<-->	atinv7	.017	.006	2.780	.005	.180
sex	<-->	Same Class Percent	-.037	.011	-3.559	***	-.229
sex	<-->	atinv7	.024	.014	1.710	.087	.098
Same Class Percent	<-->	atinv7	.016	.010	1.496	.135	.098
e1	<-->	e3	-.009	.014	-.627	.531	-.147
e4	<-->	e2	.014	.006	2.283	.022	.325

Major Model 2: Unstandardized and Standardized Estimates

			B	S.E.	C.R.	p	β
Student Eng Spring	<---	Peer Group Engagement Profile Fall	.238	.122	1.955	.051	.190
Student Eng Spring	<---	Student Engagement Fall	.911	.195	4.666	***	.672
Student Eng Spring	<---	Group Stability	.053	.176	.305	.761	.027
Student Eng Spring	<---	Person to Group Difference	.227	.140	1.623	.105	.132
Student Eng Spring	<---	Achievement	.094	.030	3.115	.002	.335
Student Eng Spring	<---	Fall Parent Involve	-.020	.057	-.355	.723	-.024
Student Eng Spring	<---	Network Size	.007	.008	.841	.401	.055
Student Eng Spring	<---	Percent Same Sex Peers	-.075	.219	-.344	.731	-.024
Student Eng Spring	<---	Sex	.044	.085	.519	.604	.036
Student Eng Spring	<---	Percent in Same Class	-.115	.140	-.820	.412	-.063
Student Eng Spring	<---	Fall Teacher Involve	-.128	.128	-.993	.320	-.102
BehEng7Network	<---	Peer Group Engagement Profile Fall	1.000				.927
EmoEng7Network	<---	Peer Group Engagement Profile Fall	.716	.045	15.740	***	.915
tbeh8n	<---	Student Eng Spring	1.000				.846
temo8	<---	Student Eng Spring	.610	.059	10.263	***	.818
temo7	<---	Student Engagement Fall	1.000				.889
tbeh7	<---	Student Engagement Fall	1.502	.072	20.839	***	.909

Major Model 2: Covariances and Correlations

			Variance	S.E.	C.R.	P	r
Student Engagement Fall	<-->	Peer Group Engagement Profile Fall	.092	.016	5.797	***	.431
Achievement	<-->	Peer Group Engagement Profile Fall	-.005	.089	-.060	.952	-.005
Person to Group Difference	<-->	Peer Group Engagement Profile Fall	-.031	.011	-2.719	.007	-.184
Group Stability	<-->	Peer Group Engagement Profile Fall	.028	.012	2.311	.021	.197
Fall Parent Involve	<-->	Peer Group Engagement Profile Fall	.067	.023	2.891	.004	.194
Network Size	<-->	Peer Group Engagement Profile Fall	.325	.154	2.108	.035	.134
Percent Same Sex Peers	<-->	Peer Group Engagement Profile Fall	.011	.006	1.753	.080	.115
Sex	<-->	Peer Group Engagement Profile Fall	.061	.016	3.907	***	.253
Percent in Same Class	<-->	Peer Group Engagement Profile Fall	.030	.011	2.729	.006	.187
Fall Teacher Involve	<-->	Peer Group Engagement Profile Fall	.097	.016	5.978	***	.418
Person to Group Difference	<-->	Achievement	-.223	.066	-3.393	***	-.295
Group Stability	<-->	Achievement	.168	.069	2.426	.015	.261
Achievement	<-->	Student Engagement Fall	.491	.084	5.843	***	.514
Achievement	<-->	Fall Parent Involve	.233	.124	1.885	.059	.150
Achievement	<-->	Network Size	1.116	.840	1.329	.184	.104
Achievement	<-->	Percent Same Sex Peers	.033	.035	.936	.349	.079
Achievement	<-->	Sex	.130	.082	1.575	.115	.121
Achievement	<-->	Percent in Same Class	.086	.061	1.413	.158	.122
Achievement	<-->	Fall Teacher Involve	.345	.084	4.103	***	.333
Group Stability	<-->	Person to Group Difference	-.026	.009	-2.886	.004	-.242
Person to Group Difference	<-->	Student Engagement Fall	-.064	.011	-5.754	***	-.411
Person to Group Difference	<-->	Fall Parent Involve	-.019	.017	-1.166	.243	-.076
Person to Group Difference	<-->	Network Size	-.280	.113	-2.488	.013	-.158
Person to Group Difference	<-->	Percent Same Sex Peers	-.001	.004	-.123	.902	-.008
Person to Group Difference	<-->	Sex	-.007	.011	-.592	.554	-.037
Person to Group Difference	<-->	Percent in Same Class	-.002	.008	-.298	.765	-.020
Person to Group Difference	<-->	Fall Teacher Involve	-.036	.011	-3.245	.001	-.210

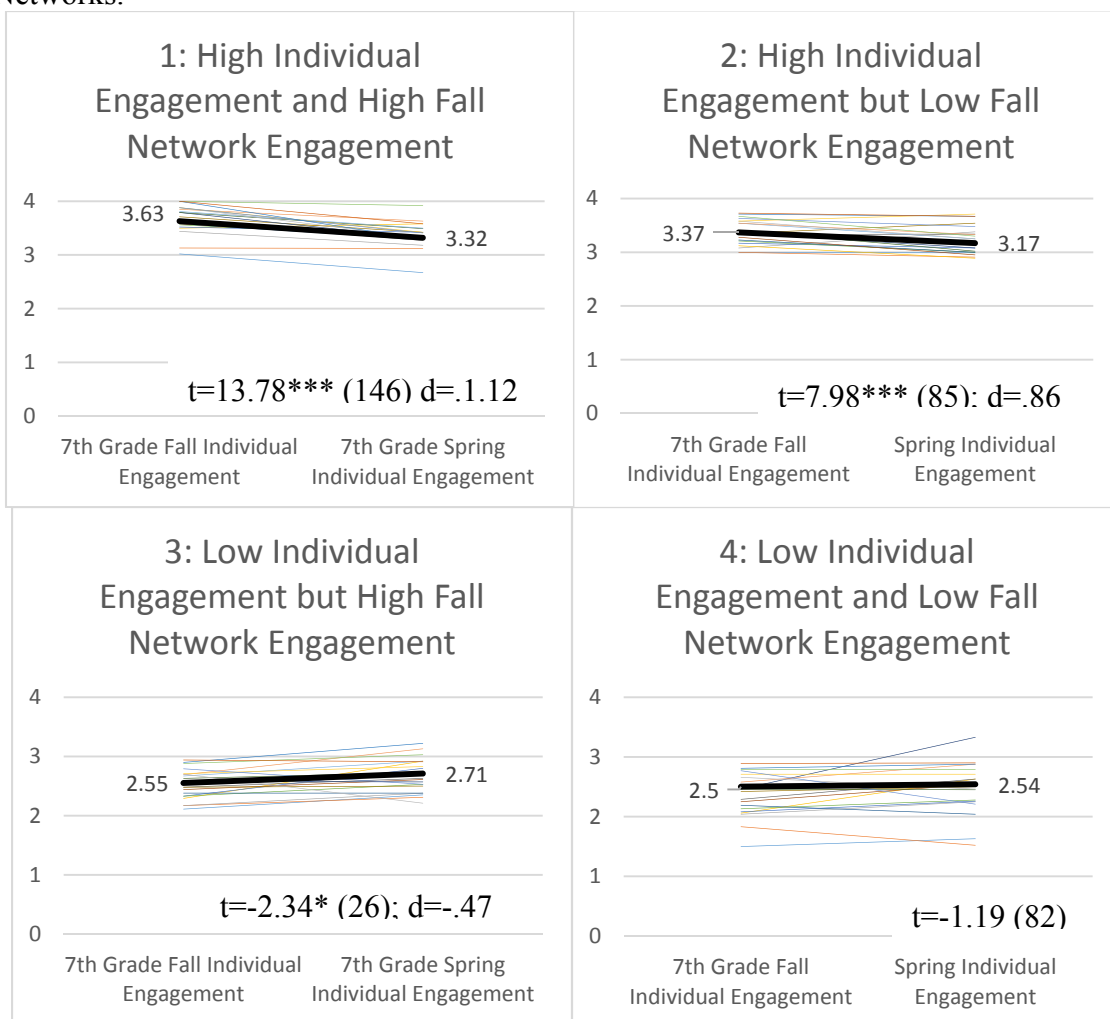
Major Model 2: Covariances and Correlations

			Variance	S.E.	C.R.	P	r
Group Stability	<-->	Student Engagement Fall	.026	.011	2.277	.023	.196
Group Stability	<-->	Fall Parent Involve	.030	.018	1.679	.093	.138
Group Stability	<-->	Network Size	-.055	.120	-.458	.647	-.036
Group Stability	<-->	Percent Same Sex Peers	.012	.005	2.482	.013	.202
Group Stability	<-->	Sex	.038	.012	3.122	.002	.251
Group Stability	<-->	Percent in Same Class	-.012	.008	-1.435	.151	-.117
Group Stability	<-->	Fall Teacher Involve	.020	.012	1.718	.086	.140
Fall Parent Involve	<-->	Student Engagement Fall	.088	.020	4.339	***	.275
Network Size	<-->	Student Engagement Fall	.278	.136	2.054	.040	.124
Percent Same Sex Peers	<-->	Student Engagement Fall	.012	.006	2.098	.036	.141
Sex	<-->	Student Engagement Fall	.032	.013	2.414	.016	.144
Percent in Same Class	<-->	Student Engagement Fall	.023	.010	2.284	.022	.157
Fall Teacher Involve	<-->	Student Engagement Fall	.155	.016	9.592	***	.718
Fall Parent Involve	<-->	Network Size	.600	.213	2.818	.005	.165
Fall Parent Involve	<-->	Percent Same Sex Peers	-.010	.009	-1.137	.255	-.073
Fall Parent Involve	<-->	Sex	.048	.021	2.329	.020	.133
Fall Parent Involve	<-->	Percent in Same Class	-.015	.016	-.936	.349	-.061
Fall Parent Involve	<-->	Fall Teacher Involve	.030	.021	1.448	.148	.085
Network Size	<-->	Percent Same Sex Peers	.006	.060	.094	.925	.006
Network Size	<-->	Sex	.675	.144	4.701	***	.269
Network Size	<-->	Percent in Same Class	-.005	.105	-.043	.966	-.003
Network Size	<-->	Fall Teacher Involve	-.011	.140	-.078	.938	-.004
Percent Same Sex Peers	<-->	Sex	.012	.006	2.022	.043	.125
Percent Same Sex Peers	<-->	Percent in Same Class	.005	.004	1.120	.263	.072
Percent Same Sex Peers	<-->	Fall Teacher Involve	.017	.006	2.879	.004	.186
Sex	<-->	Percent in Same Class	-.037	.011	-3.529	***	-.226
Sex	<-->	Fall Teacher Involve	.023	.014	1.650	.099	.093
Percent in Same Class	<-->	Fall Teacher Involve	.018	.010	1.705	.088	.111
e7	<-->	e2	.013	.004	3.262	.001	.366
e3	<-->	e6	.052	.018	2.899	.004	.447
e4	<-->	e7	.019	.008	2.497	.013	.320
e1	<-->	e6	.014	.007	1.913	.056	.240

Appendix C: Post Hoc Tests

Post Hoc Analyses: High and Low Engaged Students Embedded in High and Low Networks

Post Hoc Analyses: High and Low Engaged Students Embedded in High and Low Networks.



Each figure illustrates a random sample of 20 trend lines for 7th grade students with each heavy black line indicating the average trend for each category of student from fall to Spring. Only students with low engagement who are embedded in networks where others also have a low quality of engagement show a non-significant trend from Fall to Spring. Overall, students who are highly engaged tend to decrease in engagement. This could reflect a regression to the mean, a ceiling effect, or for figure “1” could reflect the pressure of being in a highly engaged group that may cause social comparisons that are

detrimental to sustained engagement. For students ranked low in engagement but within a highly engaged group, moderate growth is shown. While this too could be floor a floor effect, a visual comparison with figure 4 in which a non-significant trend line is shown appears to indicate that the influence may be the result of socialization.

Appendix D: Suppression

Table of Chi-Square Difference Tests Indicating Suppression

Chi-square difference tests between the full model compared with each variable removed

	Chi-square All Variables Included	Df All Variables Included	Chi-square With Variable Removed	Df	Df diff	Chi-square Difference	Peer Group Beta
All Variables Included	61.382	29					.19*
Teacher Involvement	61.382	29	50.732	26	3	10.65*	.09
Parent Involvement	61.382	29	60.298	26	3	1.08	.18†
% Same Sex	61.382	29	59.828	26	3	1.55	.19*
Achievement	61.382	29	53.197	26	3	8.18*	.05
Person to Group Difference	61.382	29	48.505	26	3	15.87**	.18†
% Network members kept Fall to Spring	61.382	29	58.96	26	3	2.42	.20*
Sex	61.382	29	31.71	26	3	29.68	.22**
Network Size	61.382	29	50.87	26	3	10.51	.18†
% Same class	61.38	29	57.46	26	3	3.92	.18

A series of chi-square difference tests were conducted. At each point just one variable was removed the chi-square difference test was run, the variable was then placed back into the full model and the next variable was removed until all variables were tested.

APPENDIX E: Measures

1. Academic Engagement
2. Teacher Involvement
3. Parent Involvement

Academic Engagement

Engagement-Behavior

1. When we start something new in class, this student participates in discussions.
2. In my class, this student works as hard as he/she can.
3. When I explain new material, this student listens carefully.
4. In my class, this student does more than required.

Disaffection Behavior

5. When we start something new in class, this student doesn't pay attention.
6. When we start something new in class, this student thinks about other things.
7. In my class, this student does just enough to get by.
8. In my class, this student comes unprepared.

Engagement Emotion

9. When we start something new in class, this student is enthusiastic.
10. When working on classwork in my class, this student appears involved.
11. When working on classwork in my class, this student seems to feel good.
12. In my class, this student seems interested.

Disaffection- Emotion

13. When working on classwork in my class, this student appears worried.
14. In my class, this student is anxious.

Teacher Involvement

I wish my teacher paid more attention to me

I wish my teacher could spend more time with me

I wish my teacher knew me better

I wish I were closer to my teacher

When I'm with my teacher I feel accepted

When I'm with my teacher I feel like someone special

When I'm with my teacher I feel ignored

When I'm with my teacher I feel unimportant

Parent Involvement

My parents don't know a lot about what goes on for me

Sometimes I feel like my parents just don't understand me

My parents know a lot about what's important to me

My parents know how I feel about things