Temporal Aspects of the Group Cohesion–Group Performance Relationship in an Experiential Computerized Business Simulation

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Abstract

Research on group cohesion has generated conflicting findings. The present study was designed to examine the temporal aspects of the reciprocal relationship between group cohesiveness and group performance. A computerized business simulation was used to examine the longitudinal aspects of this relationship, as well as the impact of a group formation method. Participants were 412 undergraduate students enrolled in a third-year business strategy class. Students formed groups to participate in a semester-long computerized business strategy simulation game. Results indicate there is a significant cyclical relationship between group cohesion and group performance. In investigating the directionality of the relationship between both constructs, the "group performance leads to group cohesion" relationship was stronger than the inverse "group cohesion leads to group performance" relationship. Furthermore, the group formation method was found to influence levels of group cohesion. Practical implications and suggestions for future research are discussed.

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Stress is really an integral part of life. We set our whole pattern of life by our stress end-point. If we hit it exactly we live dynamic, purposeful, useful, happy lives. If we go over, we break. If we stay too far under, we vegetate. — Dr. Howard A. Rusk

You cannot vegetate while completing an MSc. in Administration thesis…

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Temporal Aspects of the Group Cohesion–Group Performance Relationship in an Experiential Computerized Business Simulation

I love to hear a choir. I love the humanity ... to see the faces of real people devoting themselves to a piece of music. I like the teamwork. It makes me feel optimistic about the human race when I see them cooperating like that.

— Paul McCartney

Groups are integral parts of organizations and a great deal of research has been, and is being, conducted to better understand the dynamics that occur in such groups (Levine & Moreland, 1990; Weingart, 1997). Consequently, the effects of group interaction on the organization, its goals, and its performance are also of utmost interest to researchers and managers. Research on group dynamics covers many concepts such as group routines (Gersick & Hackman, 1990); group conflict (Jehn, 1995); group diversity (Harrison, Price, & Bell, 1998; Lau & Murnighan, 1998); and other aspects of group character and behaviour. One of the concepts that has received a considerable amount of attention in the group dynamics literature is group cohesion (also referred to as group cohesiveness). This construct, and its relationships with other variables, has been researched in depth, especially its relationship to performance and productivity. A review of this literature, however, reveals that there is a rather pronounced lack of cohesion among researchers examining the group cohesiveness construct and its relationship to group performance. The lack of consistency in the literature leads to the research question for this thesis: How can we better understand the reciprocal relationship between group cohesion and group performance?

The daunting task of creating a unified summary of this disparate and somewhat inconsistent literature necessitates a broad overview of the current state of the group cohesion literature. The objective of the present study is to address the topics that are central to understanding group cohesiveness and its relation to group performance. This will be accomplished by firstly conducting a review of how researchers have operationalized cohesiveness. This will be done while focussing on the dimensionality debate—researchers disagree as to whether cohesiveness is a unidimensional or multidimensional construct. It is also imperative to consider the problems associated with evaluating a group-level construct using individual-level measures. Secondly, the known antecedents and consequences of cohesiveness will be described, while a focus on the popular, and largely anecdotal, positive relationship between group cohesiveness and group performance is maintained. Finally, the potential impact of temporal effects on the relationship between cohesiveness and performance will be reviewed.

Operationalization of Group Cohesion

Cohesion can be described as group members' inclinations to forge social bonds, resulting in members sticking together and remaining united (Carron, 1982). There are also definitions that focus on interpersonal fondness between group members, though these definitions are not universally accepted by researchers (Summers, Coffelt, & Horton, 1988). As far back as the early 1950s, Gross and Martin (1952) noted that there is "a lack of sufficient correspondence between the conceptual and operational definitions of cohesiveness" (p. 549). Mudrack (1989a) noted that years of research on the topic of cohesiveness have been "dominated by confusion, inconsistency, and almost inexcusable sloppiness with regard to defining the construct" (p. 45). Mudrack (1989b) addressed the disorder in the literature and

noted there are two recurring problems that occur when conducting research on constructs in the behavioural sciences, including group cohesion. The first relates to construct validity, the challenge of precisely and consistently defining a construct. The second problem is one of reliability and arises because it is difficult to measure such constructs in an experimental setting. As a result, the lack of consistent operationalization yields limited uniformity in the measurement of the cohesion construct, even 16 years after Mudrack's (1989a, 1989b) reviews on the state of the cohesion literature.

Multiple Definitions of Group Cohesion

The main source of disjunction within the field could potentially be eliminated if researchers ceased proposing new definitions for cohesion. Friedkin (2004) stated that investigators may adopt any definition for cohesion, providing it is clear and accompanied by a logical analysis. Dion (2000) also refrained from giving much importance to the definition of cohesiveness. He noted that emphasis should be put on ensuring that the "measurement and treatment of cohesion data [match the] theoretical definition of cohesion" (p. 19). However, Dion and Friedkin's comments follow more than 50 years of confusion and controversy in the cohesion literature. As a result, these recent calls to cease the search for a universally accepted definition of cohesion do not eliminate the past difficulties associated with operationalizing group cohesiveness.

Operational definitions are at the core of measures designed to test theoretical constructs. A plethora of operational definitions for one construct therefore results in an equally absurd number of measurement tools. For example, it is accurate to state that there are approximately as many methods for assessing cohesion as there are researchers investigating the construct itself. Budman, Soldz, Demby, Davis, and

Merry (1993) noted that the measures used are mostly "unsophisticated at best" (p. 200). For example, there are observer-rating scales (Budman et al., 1987) as well as self-report scales (Carron, Widmeyer, & Brawley, 1985; Dobbins & Zaccaro, 1986). Given the general view that an operational measure should match the researcher's definition of the construct being assessed, formulating a comprehensive list of measures at this time is not useful. Consequently, it is sufficient to state that researchers should simply focus on ensuring the measurement tool corresponds to the definition adopted for the investigation, regardless of what that definition is.

The variety of schools of thought used to examine cohesion results is largely responsible for the wide variety of definitions and measures. These perspectives include those from the fields of sociology, political science, military psychology, and industrial-organizational psychology (Dion, 2000; Mullen & Copper, 1994). It is essential to note that each theoretical approach typically assesses cohesion in a population related to that school of thought. As a result, psychotherapy and other types of counselling groups (Budman et al., 1993; Roark & Sharah, 1989), musicians (Dyce & Cornell, 1996), athletic teams, and other physical activity groups (Spink & Carron, 1994) are often investigated. While findings using these groups are useful, the generalizability to other groups, such as work groups, is questionable.

The use of numerous definitions and measures, as well as different schools of thought and populations, introduces yet another methodological issue: Comparability and replication of research data between studies are limited. Comparability between studies is an essential element in the quest to eliminate the confusion that permeates the cohesion literature (Drescher, Burlingame, & Fuhriman, 1985). Cota, Longman, Evans, Dion, and Kilik (1995) stated that the lack of replication is an important source of diverging research findings. This is consistent with other researchers' shared

opinion that replication of existing cohesion studies may help remedy the non-comparability between a great number of studies (e.g., Mudrack, 1989). Prior to proceeding with replication of existing studies, however, it is essential to review the relevant literature and identify the main source of divergence among the differing approaches used. It is also imperative to identify approaches that have yielded strong empirical support or particularly interesting findings.

Dimensionality of the Group Cohesion Construct

There are several sources of debate relating to the cohesion construct. The most fundamental concern appears to be the dimensionality of the construct. Carron et al. (1985) noted that the complexities associated with weighting factors believed to comprise the global notion of cohesiveness led early researchers to consider it to be a single-factor construct. Shaw (1981) noted that the unidimensional approach may result in the use of a single scale. Such a scale would only evaluate a specific element of cohesion that the researcher deems synonymous with the construct, such as attraction of group members to the group, attendance at group meetings, or members' desires to remain in the group. To better understand the dispute, it is important to briefly trace the historical paths of the various cohesiveness researchers.

Group Cohesion as a Unitary Construct

Early group cohesion researchers maintained it was a unitary (unidimesional) construct. Kurt Lewin (1935) first used the term cohesiveness to describe an important aspect of group dynamics. According to Dion (2000), Lewin viewed cohesion as a set of forces of attraction and repulsion that kept group members together. Seashore (1954) defined cohesiveness as a member's "attraction to the group or resistance to leaving" (p. 11) and conducted research in an industrial setting. Following his definition of group cohesion, Seashore designed a five-item scale to

operationalize and measure the construct. Seashore limited the measurement of group cohesion to assessing group members' attraction to remaining part of the group. This scale required group members to compare their group to similar groups operating within the same industrial work-group setting, and note their desire to remain within their current work group. A thorough review of the literature reveals that Seashore's unidimensional definition of cohesiveness is the most often cited and used conceptual definition, central to an assortment of scales devised to evaluate group cohesion. Other researchers have adapted Seashore's definition of group cohesiveness and scale to their studies (Harrison et al., 1998; Klein & Mulvey, 1995).

Building upon Seashore's findings, Van Bergen and Koekebakker (1959) also proposed a unitary, or unidimensional, perspective of cohesiveness. They claimed that attraction to the group is "on a lower level of abstraction than cohesiveness" (p. 82). As a result, attraction to the group may be more easily operationalized and measured in an experimental context. Attraction to the group is defined as an interaction of a group member's motives that results in the individual either leaving or remaining in the group. Evans and Jarvis (1980) argued that attraction to group and group cohesiveness are related but distinct constructs. Therefore, a problem with Seashore's (1954) definition, and those based upon his definition, arises. Its focus on the individual's desire to remain within the group questionably reduces the group-level construct of cohesion to an individual-level construct. Van Bergen and Koekebakker acknowledged the threat of committing such errors by stating that definitions describing cohesion as a summation of individual perceptions, or additive in nature, fail to consider the group as a whole. Similarly, Mudrack (1989a) noted that parsimonious definitions of cohesion, such as Seashore's (1954) and Van Bergen and

Koekebakker's (1959), run the risk of focussing more on individuals rather than on the groups they comprise.

Group Cohesion: More Than a Unitary Construct

While Seashore's (1954) definition has received considerable attention and use, the vigorous debate on cohesion appears to have developed mainly from Festinger, Schachter, and Back's (1950) seminal group-dynamics study on a student housing community. They defined group cohesiveness as being "the total field of forces that act on members to remain in the group" (p. 37). Festinger (1950) later modified that definition to "the resultant of all forces acting on members to remain in the group" (p. 274). The word *forces* is an important element of both Festinger's (1950) and Festinger et al.'s (1950) definitions. This indicates that Festinger and his colleagues supported a multidimensional approach, which incorporated the influence of numerous constructs. Given the difficulties associated with the unidimensional approach to group cohesiveness, models composed of more than one factor are perhaps more promising for future research.

Gross and Martin (1952) proposed an alternative, multidimensional definition for group cohesion. They suggested that cohesiveness could be appraised by assessing its resistance to disruptive forces, and formulated the seven-item *Gross Cohesiveness Questionnaire*. Interestingly, along with Seashore's (1954) and Festinger's (1950) work, Gross and Martin's (1952) article is central to cohesion's operationalization in the literature. Gross and Martin's most cited contribution to the field centers around Festinger et al.'s (1950) approach. They noted that if cohesion is additive in nature, such as Festinger et al. (1950) propose, then its measurement must reflect each of the conceptualized factors. Gross and Martin also alluded to the difficulty of identifying the specific and individual forces assumed to comprise cohesion. To remedy this

problem, they suggested reconceptualizing cohesion as a multidimensional construct, and also proposed shifting the definition from the *total* to the *resultant* field of forces. As noted earlier, Festinger (1950) had already published material clarifying the modification from *total* to *resultant*, two years prior to Gross and Martin's (1952) article. Therefore, it is obvious that early investigators failed to integrate the findings and theoretical assumptions other contemporaries had put forth. Nevertheless, it is largely Gross and Martin who are credited with having made this slight adjustment, which ultimately changed the focal point of cohesion from its causes to its effects (Dion, 2000). This modification had a major impact on the conceptual and experimental approaches adopted by later researchers.

Two-Dimensional Approaches to Group Cohesion

Simplified two-dimensional models are also at the center of group cohesion empirical studies. At the heart of most two-dimensional models is the notion of attraction of the group, which may be described as the positive valence of the group and its goal. This notion has received considerable support and has generated a significant amount of research that seeks to clarify the characteristics of the attraction (Lott & Lott, 1965; Van Bergen, & Koekebakker, 1959).

Interestingly, some researchers maintain that group cohesion and group attractiveness are distinct constructs. For example, Evans and Jarvis (1980) assert that while attraction to the group is a variable related to group cohesion, it is distinct from cohesion. The difference between these two phenomena suggests that there is more to group cohesion than simple attraction by group members to the group. *Means control* is the degree to which the group decides what goals are important for its members. This notion introduces an additional aspect to the construct of cohesion—that of the task that groups are working on. Evans and Jarvis integrated this notion when they

included task-based and interpersonal cohesion elements in their model. Briefly, task-based cohesion is the importance of the group allowing its members to attain their individual goals, whereas interpersonal cohesiveness represents the positive interactions among group members.

It appears that Mikalachki (1969) first suggested this social–task distinction, which has received considerable attention from a number of researchers using differing perspectives to investigate the cohesion construct (Carron & Brawley, 2000; Dobbins & Zaccaro, 1986). While the proposed distinction between task and social cohesion is promising, recent research apparently fails to integrate both elements simultaneously. Investigators who ignore the potential impact of both social and task concepts on the group cohesiveness construct risk generating yet more confusion in the literature. For example, Bollen and Hoyle (1990) defined perceived cohesion as "an individual's sense of belonging to a particular group and his or her feelings of morale associated with membership in the group" (p. 482). They used a six-item scale to assess perceived cohesion in large groups. Other researchers have supported Bollen and Hoyle's scale applicability to small groups of four and five members (Chin, Salisbury, Pearson, & Stollak, 1999). Bollen and Hoyle's two-dimensional "perceived cohesion" model is composed of belongingness and morale. Bollen and Hoyle claim that cohesion is the result of group members' appraisal of both these concepts. Belongingness represents a sense of individual identification. Morale represents the affective element of perceived group cohesion. Interestingly, as Dion (2000) noted, both components of their model reflect solely social cohesion, and appear to almost neglect task cohesion. Given the empirical support for a model integrating both social and task cohesion, Bollen and Hoyle's approach seems to yield limited promise for future investigations. Similarly, Friedkin (2004) recently applied the term *social*

cohesion synonymously with general cohesion in various types of groups. Dion and Evans (1992) stated that the important distinction between task and social cohesion that has derived from various researchers and approaches is a milestone in the cohesion field of study. A review of the cohesion literature suggests that most contemporary researchers support such a distinction.

The distinction between task and social components of group cohesiveness has generated an alternative, two-dimensional approach to cohesion. Zaccaro and Lowe (1988) conceptualized cohesivesness as being composed of both task-based and interpersonal cohesion. Their two-dimensional model has increasingly sparked interest and gained support by other researchers (Dion, 2000; Mudrack, 1989a). Zaccaro and Lowe (1988) stated that a multidimensional approach to cohesion is "supported if each type of cohesion has different consequences" (p. 556). Another study by Zaccaro (1991) generated data supporting the abandonment of the unitary perspective on group cohesiveness. Zaccaro found that task cohesion is more strongly linked to higher individual performance and lower absenteeism than is interpersonal cohesion. These differential results for both social and task cohesion provide empirical support for a two-dimensional model.

Adopting Festinger et al.'s (1950) definition of cohesion, Dobbins and Zaccaro (1986) developed a scale composed of items obtained from a variety of sources, including Festinger's (1950) scale and that of Seashore, Lawler, Mirvis, and Cammann (1982). Their proposed eight-item scale assessed individual group members' perceptions about their group's cohesion and tapped solely into social cohesion. Dobbins and Zaccaro's method and approach to group cohesion are compatible with Mudrack's (1989a) recommendations for creating a more coherent structure in the group cohesion literature. Mudrack (1989b) reiterated the importance

of selecting a few existing measures in order to provide comparability between studies. He noted that Dobbins and Zaccaro's scale "could probably be tailored to fit most samples" (p. 781). Mudrack (1989a) also cited the importance of researchers linking "their nominal definition of [cohesion to] its measurement or operationalization." (p. 44).

Zaccaro and Lowe (1988) used an additive group task to examine the differential effects of task and interpersonal cohesion. Their findings suggest that task cohesiveness facilitates performance, while interpersonal cohesiveness inhibits maximum productivity. Task-interfering interactions between group members are believed to be at the root of this hindrance to productivity. Interestingly, Zaccaro and McCoy (1988) found that when groups require interaction to succeed on a group task, both forms of cohesion are required. These researchers found that if groups scored highly on either task or interpersonal cohesion, their performance did not differ from those groups that displayed low cohesion in both.

Additional support for distinguishing between social and task elements of cohesion comes from Carless and De Paola (2000). These researchers suggested that social cohesion may be a required antecedent to task cohesiveness. Mullen and Copper (1994) examined the relationship between cohesion and performance and found that task cohesiveness increased performance more than social cohesiveness did. However, recent critics believe these conclusions must be met with caution, as the studies included in Mullen and Copper's meta-analysis did not measure cohesion and performance at the same levels of analysis (Beal, Cohen, Burke, & McLendon, 2003). Beal et al. noted that cohesion and performance can be measured at both the individual and group level. Mixing levels of analysis in assessing effect sizes results in conceptual ambiguity and uncertain results. From the research findings cited thus

far, it is possible to conclude that Zaccaro and his colleagues' findings indicate a two-dimensional model of cohesion that integrates task and interpersonal cohesion is appropriate. The choice of the model is simply dependent upon the nature of the research question.

A Multidimensional Approach to Group Cohesion

Festinger's (1950) and Gross and Martin's (1952) proposed shift from investigating the causes to focussing on the effects of group cohesiveness had a major impact on the conceptual and experimental approaches adopted by later researchers. For example, Carron (1982) adopted the effects approach by operationalizing cohesiveness as being the "dynamic process that is reflected in the tendency for a group to stick together and remain united in the pursuit of its goals and objectives" (p. 213). Brawley, Carron, and Widmeyer (1988) ultimately adopted the definition of cohesion that describes it as being the group's resistance to disruptive forces. This perspective appears to be more conceptually coherent as it focuses on group dynamics rather than on a simple aggregation of individual members' desires to remain within a group. Over the past 20 years, Carron, Widmeyer, and Brawley have collectively investigated cohesion extensively in sports teams and other physical activity groups. Through a group of studies, they have proposed a theory-driven hierarchical conceptual model to examine cohesion in sports teams. They have also developed a promising measure for assessing cohesion (Carron et al., 1985).

The article written by Carron et al. (1985) is a thorough meta-analysis of group cohesion studies, as well as a factor analysis, which paved the way for the development of a four-factor, 18-item Group Environment Questionnaire (GEQ) Widmeyer, Brawley, and Carron (1985) provided an in-depth explanation of the GEQ and its four-factor structure. The first factor represents the individual group members'

perceptions about the group's *wholeness*. The second is associated with the individual members' personal concerns about remaining within the group. Therefore, it appears that the former factor is reserved for perceptions of the group as a totality while the latter relates to the capability of the group to nurture personal objectives (Carron & Brawley, 2000). The authors suggested that group cohesion becomes a four-dimensional construct when the two main foci noted above are subdivided into task- or socially-related cohesion, which matches Mikalachki's (1969) task–interpersonal distinction. While validating the new cohesion measure, Carron et al. (1985) eventually operationalized cohesion as being composed of two predominant types of cognition. Preliminary results from studies using the GEQ have demonstrated this instrument's validity (Brawley et al., 1988).

While most studies apply the GEQ in sports groups, researchers have attempted to adapt this questionnaire to other types of groups, such as musicians (Dyce & Cornell, 1996) to measure various aspects of group cohesion. However, many researchers who administer the GEQ in their studies are unable to demonstrate its factorial validity. Rather, investigators obtain results that support the existence of a three-factor model (Carless & De Paola, 2000; Dyce & Cornell, 1996). The three factors include task and social cohesion, as well as attraction to the group. Recent research supports the claim that task cohesion is the facet of cohesion most related to performance (Carless & De Paola, 2000; Mullen & Copper, 1994; Zaccaro, 1991). Nonetheless, social interaction is also considered an important element of group cohesion; however, this interaction occurs while group members are working on a task. Therefore, the social aspect is not normally at the forefront of the members' awareness during activities. As mentioned above, the GEQ has been repeatedly used with sports teams and other physical activity groups; however, the factor structure and

it validity remains to be demonstrated in other types of groups. Given the limited findings supporting Widmeyer et al.'s (1985) four-factor model and the GEQ's reliability and validity, its use in empirical research is questionable. However, Carless and De Paola (2000) and Dyce and Cornell's (1996) findings lend support for a two-dimensional approach, one that includes social and task dimensions. Such a model could be promising if broadly adapted to other types of groups.

Group Cohesion and Levels of Analysis

The cohesion construct began as a unidimensional construct. Over time, multidimensional models have emerged and consistently receive empirical support. Factor analysis is now a great methodological tool for meta-analyses and finding common factors among various types of studies measuring different aspects of cohesion. Factor analysis often reduces models to two or three factors. For example, Carron et al. (1985) used factor analysis to reduce the number of cohesion indicators. Friedkin (2004) and many other researchers have reviewed the strengths and weaknesses of factor analysis in the group cohesion literature.

There is a significant amount of discordance in the literature regarding the appropriate level to use for assessing cohesion. Assessing a group-level construct, such as cohesion, using individual-level information is a central concern (Dion, 2004). Keyton (2000) noted that researchers have often studied individual group members rather than focussing on the group as a unit. Friedkin (2004) stated that the diversity of definitions of cohesion revolves around the problem of linking individual- and group-level constructs. For example, "groups are cohesive when group-level conditions are producing positive membership attitudes and behaviours and when group members' interpersonal interactions are operating to maintain these group-level conditions" (p. 410). Klein, Dansereau, and Hall (1994) argue that if the theory,

measurement, and statistical levels of analysis are not the same, controversy and confusion in the literature eventually ensue. Cota et al. (1995) conducted a theoretical review and also remarked that the unit of analysis is an important concern when using factor analysis to determine cohesiveness dimensionality. Thus, it is clear that the unit of analysis for group constructs, such as cohesiveness, warrants further investigation.

The methods used to study group-level constructs are limited. Writing about collective efficacy, Lindsley, Brass, and Thomas (1995) summarized three methods suggested by Gist (1987) and offered a fourth method. The first method is the aggregation of individual beliefs (George & James, 1993). This method can be used if there is a sufficient level of homogeneity of responses within the group. The investigator using this approach must assume that a group is a simple collection of individual beliefs, and not acknowledge the group as an entity on its own. A second method involves using an average of individual perceptions of group processes (Earley, 1993). As with the first, this method fails to treat the group as an entity that has a collective mind. The average of individual perceptions is not an index of within-group perceived attitude similarity (Weick & Roberts 1993). A third method, suggested by Gist (1987), consists of having the group respond collectively to the survey by reaching a consensus on a response to each item and respond to it as a group. This treats the group as an entity but requires the survey to be completed as a group, a practice that can introduce other problems. The fourth method, recommended by Lindsley et al. (1995), is the use of individuals within a group as informants about the collective beliefs of the group. This subtle distinction asks the participants to provide their thoughts on group beliefs and assumes that individuals within a group have access to the collective mind of the group (Weick & Roberts, 1993). Since group cohesion is a group construct and cannot exist without a group, the fourth method

appears to be an appealing and appropriate methodology for measuring group cohesion. This requires the researcher to use the group members as informants and then calculate the within-group average among the individuals within the group.

Using individuals to capture group-level constructs, such as cohesion, has been a source of considerable debate about multi-level analysis (Klein et al., 1994). Some researchers believe that using an aggregation of individual perceptions fails to account for the complex socio-cognitive processes that occur within a group (Gist, 1987). Carless and DePaola (2000) determined that it is the group-level perception of group cohesion that is important, rather than the individual-level attraction to the group. Carron et al. (2003) noted that Janis's (1972) concept of *groupthink* supports the view that groups may develop a way of thinking, different from each of the individuals' ways of thinking. Janis (1982) also suggested that cohesiveness is an antecedent to groupthink. Carron et al. (2003) conducted an empirical investigation into the notion that group members' individual perceptions of the group accurately represent shared beliefs, and can be a useful indicator of the group construct of cohesion. These researchers also reported the degree of consensus about the level of cohesion among group members can result in high, moderate, or low cohesion. They argue that both high and low cohesive groups may emerge from groups displaying a high degree of consensus. Consistent success or failure, as well as other factors, may lead groups to agree that their team is cohesive or not. As a result, consensus about cohesion does not necessarily indicate a high level of cohesiveness.

Cota et al. (1995) noted that that no one unit of analysis is more advantageous than another; however, the *individual* level of analysis is most popular. It is apparent in reviewing a number of studies having used the individual level of analysis have found it to be problematic. This is simply due to the fact that it is questionable

whether or not the complex interactions between group members are actually assessed. Some researchers maintain that the appropriate level of analysis is the aggregation of individual perceptions (Buckner, 1988). Festinger et al. (1950) reasoned that group cohesion most likely results in members influencing other group members to develop a rather homogeneous set of behaviours and attitudes. The emergence of similar behaviours and attitudes may be described as a level of group homogeneity. Using summation is a useful practice if there is a high level of homogeneity among group members (George & James, 1993). Evidently, an insufficiently high level of homogeneity could indicate that cohesion does not exist in that group.

Interestingly, recent experimenters have used Seashore's (1954) school of thought and measure of cohesion to examine the unit of analysis issue. For example, Harrison et al. (1998) applied Seashore's measure of cohesion to obtain an aggregation of individual ratings. The mean of these individual ratings was used as a group rating. Harrison et al. argued that using a group-level value is necessary, considering that cohesion is a group-level construct. In addition to using aggregated results, these researchers also integrated an index of within-group agreement, as described by James, Demaree, and Wolf (1984). Moritz and Watson (1998) have proposed that an acceptable range of value for the index of agreement in research should be situated between 0.50 and 0.80. Recent research in the assessment of group cohesiveness has adopted this recommendation (e.g., Burke et al., 2005). It is important to note, however, that Moritz and Watson also suggested a value of 0.90 may be required for applied purposes. It is unclear, however, what contexts are considered to be *applied.* These authors also reported that within-group agreement has an equally important impact on group cohesion assessment as between-group

variability. Between-group variability is crucial because measurements of group cohesion must assess variations between groups.

Studies examining group-level constructs rely increasingly on the use of an index of agreement r_{wg} between all respondents. As mentioned above, Moritz and Watson (1998) cite critical values above 0.50 to 0.80, depending on the research question, for empirical investigations. However, Carron et al. (2003) claimed that eliminating groups that do not demonstrate high levels of agreement is a counterproductive practice. Carron et al. (2004) examined the relationship between cohesion and success of various sports teams. They measured the statistical effect of eliminating groups with low indexes of agreement. Results demonstrate that statistically controlling the variation between groups increases the magnitude of the link between cohesion and success. As a result, using total sample size, without considering within-group agreement, yields more conservative findings. These findings support Dion's (2000) claim that the nature of the research question should dictate the choice of statistical procedures to assess the value of group-level constructs.

The cohesion literature is littered with findings that resulted from the application of various statistical procedures. Dion (2000) noted that the nature of the research question determines whether or not a value of group cohesion can be obtained by using individuals' perceptions. Similarly, Cota et al. (1995) stated that the level of analysis must simply correspond with the specific areas of investigation. Carron et al. (2003) concluded that researchers must continue to evaluate the applicability of certain statistical procedures when examining group cohesion. It is therefore apparent that there is no proscribed manner in which analysis should be conducted when investigating group-level constructs such as cohesion. The literature

repeatedly reiterates the importance of considering the study's design, and adopting methodological and statistical procedures that correspond to the study's underlying theoretical approach.

Theoretical Framework of Group Cohesion

The complexity of the cohesiveness construct yields methodological problems, linked to investigating its relation to other variables. Some researchers have integrated numerous variables into intricate cohesion models. For example, Pillai and Williams' (2004) model examined the relationship between transformational leadership, group cohesiveness and commitment, performance, and self-efficacy. The existence of such complex models may lead to the assumption that there is a consensus among researchers in the field of cohesion, and that the understanding of the cohesion construct is thorough enough to permit the investigation of higher-order relationships with other variables. However, even narrative reviews and meta-analyses conducted solely on the cohesion construct itself have failed to yield consistent findings (Mullen & Copper, 1994). Therefore, complex models linking a number of different constructs may be premature, given the apparent disagreement in the cohesion literature.

As noted above, Festinger's (1950) and Gross and Martin's (1952) articles suggesting a shift from a *total* to a *resultant* field of forces in cohesion's definition altered the general approach adopted to conduct research on group cohesion. This in turn resulted in less attention directed toward understanding the antecedents of cohesion and more attention directed toward comprehending its consequences. In more recent research, both approaches comprise important elements that are central to a better understanding of cohesiveness. For example, Friedkin (2004) included two sections describing the antecedents and consequences of cohesive behaviours in his narrative on social cohesion. This approach is especially useful for organizing and

describing the research findings relevant to both the antecedents and consequences of group cohesiveness.

Antecedents to Group Cohesion

In a reviewing the literature, identifying the antecedents of group cohesion is somewhat more difficult than assessing its consequences, mainly because many empirical studies measure cohesion after a certain level of interaction among group members has occurred. This may be because identifying antecedents is a more challenging task. Nonetheless, some antecedents have been described by a few researchers. Cartwright (1968) drew upon previously conducted research to establish general comments relating to the group cohesiveness construct. He indicated that previous research findings support the notion that a member's intention to remain within the group is a precursor to cohesion, and is often included in various definitions of cohesion. Hogg (1972) determined that a member's identification with the group could also play an important role in subsequent levels of cohesiveness. As well, Lott and Lott (1965) discussed the impact of interpersonal ties on group cohesion and suggested attraction to a group and its members may be translated into group cohesion. A challenge for investigators examining the antecedents for cohesiveness remains distinguishing the *actual* antecedents from the *definitions.* Definitions of cohesiveness often include these same antecedents, thereby confounding the predictors and outcomes of cohesion.

Consequences of Group Cohesion

The list of cohesion's consequences is far more exhaustive than that for its antecedents. Other than duration of membership within the group, there are a number of possible outcomes, including those that may be assessed at the interpersonal level and the organizational level. Friedkin (2004) cited the influence members have on one

another as well as other indicators of interpersonal influences, such as cooperation and participation. Interestingly, the consequences of cohesiveness are often described in the organizational context. Cohesiveness is also associated with a number of positive organizational outcomes, including increased organizational citizenship behaviour (Kidwell, Mossholder, & Bennett, 1997). In particular, Seashore (1954) found a negative relationship between group cohesion and job-related tension. Mikalachki (1969) found an inverse relationship between cohesion and absenteeism. Together, such findings indicate that cohesion is related to a number of positive and sought-after consequences.

Group Cohesion as a Mediator and Moderator

Most empirical studies focus on direct relationships between cohesion and other variables. There are comparatively few empirical results indicating that cohesion moderates certain relationships. For example, Dobbins and Zaccaro (1986) obtained strong support for the claim that group cohesiveness moderates the relationship between leader behaviour and subordinate satisfaction. Zaccaro (1991) suggested that a multidimensional model of cohesion promises to clarify notions regarding cohesion's role as either a mediator or a moderator.

The Relationship Between Group Cohesion and Group Performance

No variable linked to cohesion has received as much attention and investigation as has performance or productivity. The link between cohesiveness and performance appears to be complex and warrants special consideration prior to being investigated. The intuitive appeal of a positive relationship between group cohesiveness and performance has resulted in the link being more often assumed than empirically and experimentally examined (Shaw, 1981). In summary, a strong sense of cohesion is believed to improve the communication between group members,

which in turn results in greater participation as well as increased goal, task, and role acceptance (Cartwright, 1968). Shaw noted the expected positive relationship between performance and cohesion results from the popular belief that group members will work harder to achieve group goals when cohesion is high. A number of organizations have developed training programmes that directly focus on influencing cohesion through unique group experiences, such as those offered by the outdoor adventure training organization, Outward Bound. However, some studies have empirically investigated the relation between cohesion and performance. For example, Dorfman and Stephan (1984) found evidence supporting the claim that highly cohesive groups outperform groups exhibiting lower levels of cohesion. Although these results appear to be straightforward, other researchers have obtained results leading to diverging conclusions, mainly centering on the directionality of the relationship.

Directionality of the Group Cohesion and Group Performance Link

Mullen and Copper (1994) cited two paradigms that are useful in examining the relationship between performance and cohesiveness. The *experimental* method is, as the name indicates, more experimental in nature and requires the creation of high and low cohesive groups to evaluate the effects that both group types may have on group performance. The *correlational* paradigm requires an initial assessment of the group's perception of cohesion. An estimation of correlation between cohesion and performance is then obtained. Mullen and Copper note there may be differences in the strength of the cohesion–performance effect, depending on the paradigm used. For example, the correlational paradigm tends to yield a stronger link between performance and cohesion than does the experimental paradigm.

Regardless of methodology, the various operationalizations and measures of cohesion result in inconclusive and inconclusive data that defies comparison. data.

Stogdill (1972) reviewed the existing literature on the cohesion–performance relationship and found a great degree of inconsistency, leading him to conclude that research did not support the claim that high cohesion predicts high performance levels. In reviewing the existing literature on the relationship between cohesiveness and performance, it is apparent that the equivocal results in the group cohesion–performance research mainly stem from the dissimilarities regarding the definition of cohesion and subsequently, its measurement (Mudrack, 1989a). Many researchers have examined both the cohesiveness and performance constructs independently, as well as comparatively, to identify the variables that predict both, including their moderators (Goodman, Ravlin, & Schminke, 1987). For example, Littlepage, Cowpart and Kerr (1989) obtained data supporting the notion that variables predicting cohesion differ from those that predict performance. These findings also suggest that while cohesion and performance may often be associated, this link can be weak at times.

Mudrack (1989b) reported that early investigations into the link between cohesion and productivity failed to demonstrate a direct relationship. For example, Seashore (1954) did not find a significant relationship between group cohesiveness and increased productivity. Mikalachki (1969) also failed to find a significant relationship between the two constructs. Recently, Podsakoff, MacKenzie, and Ahearne (1997) maintained this position and clearly stated that investigations into understanding the link between both variables have been inconclusive.

Meta-analyses have not succeeded in clarifying the relation between the two constructs. Evans and Dion (1991) conducted a meta-analysis and found the relationship between cohesion and performance to be a positive one, with highly cohesive groups outperforming low-cohesive groups by approximately 18 percentile points. However, they also found that sampling error was responsible for a significant

amount of variance in previous studies. Caution should be exercised when interpreting these findings as the 27 studies included in the meta-analysis used different operationalizations and differing group types. Mullen and Copper's (1994) meta-analysis supported the existence of a significant but small relationship between cohesiveness and performance. Using a cross-lagged panel correlation analysis, the proposed relationship was found to change over time as the interaction between both variables increases in frequency. They found that high group performance leads to higher subsequent levels of cohesion. Therefore, the *performance leads to cohesion* effect seems to be stronger than the *cohesion leads to performance* effect, but existing research does not provide firm and consistent guidance on this. Therefore, further empirical investigation into the directionality of the cohesion–performance relationship is merited.

Methodological Considerations

Gully, Devine, and Whitney (1995) found that the cohesiveness–performance link is stronger at the group level than at the individual level. Therefore, meta-analytic studies that approach the link from both the individual and group level of analysis may be underestimating the magnitude of the cohesion–productivity relationship. This practice may be the source of some of the equivocal empirical findings. Mudrack (1989b) observed that operationalizations of cohesiveness focussing on attraction to the group do not provide information on the possible outcomes of the construct. Recently, Beal et al. (2003) conducted a meta-analysis of the cohesion–performance literature and found a significant positive relation between both constructs. Following a theoretical review, Beal et al. argued that impeding factors may affect the measurement of performance. Simply measuring performance behaviour is not sufficient. These researchers concluded that it is essential to differentiate between

effectiveness and efficiency when conducting empirical studies. The former is a measurement of output; the latter relates to group inputs.

There are also data demonstrating the differential effects of task and social cohesion on performance. For example, Chang and Bordia (2001) conducted a study that examined a number of variables related to the cohesiveness–performance relationship. They found task cohesion to be the only significant predictor of subjective performance measures and social cohesion to be the only significant predictor of the group's grade, an objective performance measure. Considering these preliminary findings, the social cohesion–performance link may require more investigation.

Other Variables and the Cohesion–Performance Link

Inconsistent research findings may be indicative of a number of other variables involved. For example, some authors hypothesize that certain constructs, such as group conflict, may have positive impacts at specific levels and detrimental effects at other levels. As a result, these authors propose that there exists an optimal level of group conflict at which performance is maximized (e.g., Jehn, 1995). Another explanation for differential research findings is the possibility that group cohesion is affected by a number of other variables (Stogdill, 1972). For example, Gully et al. (1995) claimed that one or more moderators affect the relationship between cohesion and performance. Their moderator analysis identified task interdependence as affecting the magnitude of the cohesion–performance relationship. Interestingly, Mullen (1991) found that issues relating to group size predict a number of group processes. Further investigation revealed that cohesiveness impairs the quality of decision making in larger groups (Mullen, Anthony, Salas, & Driskell, 1994). Seashore (1954) identified a negative relationship between group cohesiveness and

job-related tension. Widmeyer, Brawley, and Carron (1990) examined sports teams composed of three and nine players. Their findings indicate that three-member groups are more task-cohesive than nine-member groups. As well, their findings indicate that groups of intermediate size are the most socially cohesive. Albanese and Van Fleet (1985) examined the effect of group size on the *free-riding* tendency, which they described as the notion of one or more group members obtaining the benefits of group membership without making a proportional contribution to the group. Their findings revealed that groups ranging between two and eight members are not sufficiently large to affect the *free-riding* tendency. Together, the studies relating to group size indicate it is an important variable that should be assessed and monitored when investigating group processes, including cohesiveness.

The proposed moderating effects of other variables, such as group drive (Stogdill, 1972), commitment to task (Elias, Johnson, & Fortman, 1989), and perceived task competence (Wech, Mossholder, Steel, & Bennett, 1998) have resulted in yet another shift in the study of the cohesion construct. The relationship between groups and diversity has also generated much interest and has provided interesting insights into the formation and evolution of groups. For example, Harrison et al. (1998) examined various sources of within-group diversity to establish whether the effects of this diversity on group outcomes would remain constant over time. Their findings indicate that different sources of diversity between group members have different impacts on a group.

The shift from simply examining existing groups to considering group member characteristics and their effects on the early stages of group development is key to advancing the field from investigating simple relationships to proposing more complex models of group cohesion—models that would take into account the other

variables that have an important impact on levels of group cohesiveness. For example, Stogdill (1972) noted that productivity and cohesiveness are related in groups where there is high group drive, which may be defined as "the degree of group arousal, motivation, freedom, enthusiasm, or esprit" (p. 27). As a result, understanding the emergence and effects of these moderators, from group formation until task completion, is essential in the investigation of the cohesion–performance link. Examining group development, as well as long-term performance following performance feedback, is central to comprehending the nature of the relationship between the cohesiveness and performance constructs.

Temporal Effects and Group Cohesion

Time affects group processes from the initial period of group formation through until group disbandment. Evans and Jarvis (1986) conducted group testing at different points in the group's life cycle to verify that their measure for attraction to group would be relevant at all points in time. Given the fact that there has been some confusion regarding the distinction between attraction to group and cohesiveness, Evans and Jarvis' approach should be adapted to further investigate the levels and impact of group cohesion at various points of a group's life cycle.

Group Formation

One starting point for understanding a specific group's dynamics and stage of development is an examination of how the group was formed. Tuckman's (1965) classic four-stage model of group development begins with *forming* but as he defines it—the stage when groups initially come together and get to know each other. As such, this limits the study of the "forming" stage of development to new groups and excludes groups with prior experience as a group.

The method of group formation may play an important role in the impact group goals have on group cohesiveness. Unfortunately, as noted by Hogg and Turner (1985), researchers tend to investigate group formation by simply examining antecedents to group formation. Arrow, Poole, Henry, Wheelan, and Moreland (2004) reviewed the temporal effects on groups as well as a number of models used to investigate the impact of time on group change. Arrow et al.'s review suggests that investigators often equate group formation with interpersonal attraction and do not consider it part of the group development cycle. McGrath (1990) outlined a time-based theory of functional groups. In it, he defined functional groups as being "an intact social system" (p. 26). While his model integrates a number of elements of group behavioural temporal patterns, the group processes cited apply to previously formed groups. As a result, McGrath failed to consider the impact of the manner in which the group was formed on group processes. In contrast, Albanese and Van Fleet (1985) integrated the group formation stage into their theoretical approach to examine the *free-riding* tendency. All in all, it appears that there is limited existing information regarding the link between methods of group formation and subsequent levels of group cohesion and performance.

Hogg and Turner's (1985) meta-analytic and narrative review of the group goal–performance link and possible moderators indicates that both newly formed and intact groups display a positive relationship between goals and productivity. These researchers also identified a trend in methodology toward using newly formed groups for study, as opposed to the previously preferred intact groups. A review of the literature suggests that researchers typically use either naturally formed groups or groups formed through random assignment. Random assignment entails researchers randomly assigning participants to groups and examining the resulting levels of group

cohesion. Random assignment also includes the notion of randomly assigning participants to treatment groups believed to display high or low cohesiveness (Zaccaro & McCoy, 1988). It appears that no prior research has examined the difference, in terms of cohesion, between naturally formed and randomly assigned groups, although it is conceivable that differences exist.

Naturally formed groups may include groups where the individuals have shared prior experience with one another. If the members of the group choose to join, it would make sense that this type of group may start off with higher levels of cohesion than groups formed by random selection. It is also plausible that groups in which members share prior social experience will have greater cohesion than groups where members have had no prior experience with each other. Hogg and Turner (1985) proposed that personal attraction may influence group formation. It is therefore possible that interpersonal attraction can influence group formation. This can occur by members relying on personal attraction to categorize others to identify with whom they wish to work or participate. As Keyton noted (2000), research on group cohesion focuses primarily on task concerns and relational aspects are considered to be of secondary concern. As a result, the relational issues of group formation, such as group formation method, require further investigation.

Previous Interaction Between Group Members

As previously mentioned, an important temporal issue relating to methods of group formation is prior experience shared between group members. Considering the evidence suggesting that group performance improves with higher levels of task cohesion, there should be positive co-variation between group task cohesion and group performance (Zaccaro & Lowe, 1988). Zaccaro and Lowe also found that increasing levels of interpersonal cohesion result in higher task commitment.

However, the potential benefits to performance from increased task commitment are jeopardized by increases in conversations between members, resulting from interpersonal cohesion. Even though Keyton (2000) argued that researchers considered task-related issues to be more influential than social issues, it appears that no investigators have yet examined the role of individuals' previous task interactions in the formation of groups. Hence, the link between group members' previous task-related interactions with other members and resulting levels of cohesion and performance has not been investigated thus far.

Cyclical Patterns in Group Processes

Temporal effects influence a number of group dynamics variables. For example, Pescosolido (2003) examined the relationship between group efficacy and overall group effectiveness through a longitudinal study. His findings suggest that early high levels of efficacy could be critical to long-term productivity, most likely through a number of mechanisms. These mechanisms include increases in feelings of control, competence, willingness to continue as a group, and a sense of well-being. Marks, Mathieu, and Zaccaro (2001) noted that temporal rhythms have an important impact on team processes and group members' behaviour. Other investigators have also examined the temporal effects of group efficacy. For example, Silver and Bufanio (1996) reported that past performance and group efficacy are positively correlated. As well, these researchers reported group efficacy was correlated to group goals and subsequent performance on a task. This type of relationship may lead to upward performance spirals such that successful performance fosters other positive predictors of performance, which in turn have a positive impact on subsequent performance. It is conceivable that similar performance cycles, both upward and downward spirals, may exist in relation to group cohesion, goals, and performance.

Cartwright (1968) recognized the need for additional investigation into the "circular causal systems" of group cohesion (p.107). A number of studies have examined both the negative and positive spirals that reportedly result from sustained inputs and outcomes over a period of time (Pethe, 2002). However, investigating such cyclical patterns in groups requires multiple measurements, something lacking in the body of current literature. As a result, methodological considerations that could provide information about cyclical relationships have been ignored. For example, researchers have noticed that in most experimental studies of groups, variance of group-level indicators is often reduced to a single value (Marks et al., 2001). Steel and Van Scotter (2003) warn against the threats of simply gathering data at a single point in time. They note that such a static approach eliminates the temporal influences, such as those found in cyclical relationships between two variables. Thus, there is little experimental and even less field data examining the temporal and cyclical effects of certain constructs, including group cohesiveness.

Temporal Considerations of the Cohesion–Performance Link

The role of directionality in the relationship between performance and cohesiveness sparks interest in a new issue. The temporal patterns of many group dynamics variables, including the cohesion–performance link, are of imperative value to investigating the nature of the relationship between the two constructs (Mullen & Copper, 1994). For example Hollenbeck, Klein, O'Leary, and Wright (1989) identified a lack of consensus in the literature as to when goal commitment should be measured in empirical studies. Their findings indicate that the relationship between commitment and performance is slightly lower when assessed before, as opposed to during or after, completion of the task. Similarly, Budman et al. (1993) used a phase-specific approach to examine cohesiveness in a group psychotherapy context. Their

findings indicate that behaviour linked to cohesion varies with the phase of therapy. The above research supports the idea that, in empirical studies, the timing of construct measurement merits much consideration.

In most studies, cohesion and the performance criteria, such as effectiveness, are measured at one point in time (e.g., Carless & De Paola, 2000). This practice has led some researchers to argue the link from cohesiveness to performance is more direct than the link from performance to cohesiveness (e.g., Dorfman & Stephan, 1984). However, other researchers, such as Bakeman and Helmreich (1975), have maintained that the effects of the latter relation are more dominant. Gully et al. (1995) claimed that studies examining the temporal effects on cohesion and performance, and the links between them, should measure the effect across constant time intervals. However, the temporal effects on the relationship between group cohesion and group performance are compounded when both variables are measured longitudinally.

A central difficulty revolves around identifying the opportune moment for measuring constructs. Klein and Mulvey (1995) examined the relationship between group goal processes, cohesion and performance. Group goals, goal commitment and cohesion were assessed twice during a 7-week group project. Performance was measured once at the end of the study. Their findings revealed similar results for both measurements of cohesion, which were separated by a 4-week time interval. Chang and Bordia (2001) failed to identify longitudinal changes in both task and social cohesion over a 5-week period. However, these researchers only assessed these two cohesion constructs twice during the duration of the study, with a 2-week interval between both measurements. Similarly, Greene (1989) examined the relationship between cohesion and productivity in work groups over a 9-month period, assessing all variables included in the study only twice. His findings indicated that there is a

reciprocal relationship between both constructs (cohesion and productivity), though other variables such as goal acceptance and group drive moderated this link. All three studies that have examined the cohesion–performance link over time have failed to yield conclusive results. This is likely due to the fact that none employed an objective measure of performance more than twice.

Spink and Carron (1994) obtained data supporting the claim that early measures of cohesiveness may be used to predict group members' potential to remain in, or leave, the group. More precisely, they found that individuals displaying low levels of perceived cohesiveness ended up leaving the group within 3 weeks of a group exercise programme. This finding leads one to question the role of performance during the first weeks following a group's formation. Taylor, Doria, and Tyler (1983) examined how performance may be upheld when groups experience successor failure. These researchers maintained that the impact negative performance feedback has on cohesion is dependent upon the attributions group members make about the causes for failure. Attributions can be described as the explanations people formulate regarding their own, and others', behaviour (Taylor et al., 1983). Their data demonstrated that cohesion may remain high, despite repeated failure and little success. This may be due to group-serving attribution biases. However, there appears to be limited information examining the role of initial levels of group cohesiveness and subsequent performance and the impact the performance has on later levels of group cohesion. Therefore, feedback on group performance is also an important concept for study.

Matsui, Kakuyama, and Uy Onglatco (1987) examined the effect of individual and group feedback in a goal–performance relationship. These investigators found that individual and group feedback increase subsequent performance if pre-feedback productivity levels were below target. As well, if only group feedback is given,

subsequent performance will increase only if the performance is below the target. These findings suggest group feedback is more beneficial to performance than individual feedback. The results from Pritchard, Jones, Roth, Stuebing and Ekeberg's (1988) study on group feedback support Matsui et al.'s data. Pritchard et al.'s longitudinal study revealed that the sequential introduction of group feedback, goal setting, and incentives into various organizational units at a U.S. Air Force base resulted in increased productivity. Effect sizes for all three variables were very large; however, incentives did not appear to increase productivity beyond feedback and goal setting. Thus, performance feedback is clearly an important topic when considering performance levels longitudinally.

The effect of time on cohesion is significant and has been investigated in a number of environments. For example, Treadwell, Laverture, Kumar, and Veerarghavan (2001) assessed group cohesiveness in condensed summer classes and compared levels with those of classes given during the regular semester. Their findings indicate that sustained social interaction, occurring mainly during a condensed 8-hour-per-day course, leads to a significant increase in cohesion in comparison to weekly courses, typical of a regular semester. This is interesting considering students have a shorter period for interaction during a condensed summer trimester. Treadwell et al. claim that sustained interaction between members is responsible for this effect. Bakeman and Helmreich (1975) also explored the impact of time on cohesiveness. They used televisions to observe aquanauts in an underwater environment and categorized their behaviour every 6 minutes. Categories included scientific work, socializing, and sleeping as the participants were in a deep-sea chamber. Findings supported the claim that performance during the first half of the experimental time period was strongly related to the cohesion level in the second half.

These researchers used a cross-lagged panel and other correlations to determine that the relationship between performance in the first half of the experiment correlated more strongly with cohesiveness in the second half of the study (0.816; $p<.05$) than the inverse correlation of cohesion in the first half with performance in the second half (0.133; $p<.72$). As a result, Bakeman and Helmrich concluded that good performance could be more important cause of cohesiveness than cohesiveness is of good performance.

The findings cited above indicate there is a lack of understanding regarding the effects of time on group cohesion. Carless (2000) stressed the importance of addressing and further investigating the temporal effects that occur in groups. Given the fact that the relationship between cohesion and performance has mostly been assessed using one measurement of both constructs, there are very few studies investigating cohesion and performance longitudinally. Therefore, future studies examining the cohesiveness–performance link must use multiple measurements to yield important information on the nature of the relationship over time.

Hypotheses

Reviewing the literature on group processes, it is obvious that groups must be studied to better understand these processes. Many studies, especially field experiments, use existing groups (e.g., Carless & De Paola, 2000; Chansler, Swamidass, & Cammann, 2003). Other researchers examine cohesion when groups are formed naturally, at the onset of the experiment (e.g., Klein & Mulvey, 1995). Some investigators do not integrate controls on group formation, and simply use random assignment. In other instances, high and low cohesive groups are formed through randomly selecting participants from assumed high and low cohesive populations (e.g., Bollen & Hoyle, 1990). The existence of variability in methods for

assigning participants to groups has failed to attract attention to the impact methods of group formation can have on initial and subsequent levels of group cohesion.

The current study examined university undergraduate students and relied upon students to form their own groups. It is possible that groups formed through random assignment may exhibit greater difficulty in developing high levels of cohesiveness, mainly because members do not choose with whom they will interact. In contrast, groups composed of *self-selected* members may exhibit higher levels of cohesion, especially if individuals rely on previous interactions with other members to form a group. It is also possible that some participants may collectively and intentionally enroll in specific sections of a given course to ensure that they may form groups with one another. Finally, other groups are possibly the result of the association of *stragglers*, those who did not succeed in identifying other students with whom to work prior to the deadline for finalizing group membership. Given the variation in the methods participants use to form groups, it is possible to contend that variations in group cohesion levels ensue from these divergent group-formation methods. Considering a range of group-formation methods, from self-selected groups of friends formed prior to the project to groups formed by stragglers, it is likely that:

H1: There will be significant differences in the level of cohesion among the five group formation categories.

In the current study, groups used *self-selection* to determine group membership. It is possible that some of these groups are composed of individuals who were previously enrolled together in other classes, without having necessarily worked on academic projects together. Nonetheless, the familiarity that follows previous social interaction may influence some individuals' decision to work with others

having shared this common academic experience. As a result, the previous social interaction potentially has a positive impact on initial levels of group cohesiveness.

Other shared sources of social interaction could equally influence cohesion levels within the group, including extracurricular activities, sports and cultural university clubs, and third-party acquaintances. Prior social interaction allows participants to form groups composed of individuals with whom they have shared positive interaction in the past, and with whom they believe they may again in the future. It is unlikely that individuals will choose to form a group with an individual with whom a negative social experience was shared. It is imperative to note that one of the most popular cited antecedents of group cohesion is intention to remain in the group (e.g., Cartwright, 1968). Based on this information, it is expected that groups composed of individuals who have shared more positive social interaction in the past than other groups will display higher levels of group cohesiveness. This suggests that: *H2a: Higher levels of prior social interaction will be positively associated with levels of group cohesion.*

The posited effect of prior social interaction on group cohesiveness is expected to remain constant over time. It is believed that groups will use previous social interaction as a springboard for interaction within the current group. It is possible that previous social interaction will lead to higher levels of initial social cohesion. Some researchers have proposed that social cohesion may be an antecedent to task cohesion (Carless & De Paola, 2000). Based on this premise, it is possible that the benefits of the previous social interaction will continue to affect the group dynamics over a long period of time. Hence, the link between prior social interaction and group cohesion may be described as:

H2b: The positive association between prior social interaction and group cohesion will be constant across all measurements of group cohesion.

It is also possible that some students may have had the opportunity of working with other classmates in the context of other university classes, in either formal group projects or informal study groups. It is therefore likely that certain groups are composed of two or more members who are familiar with each other's work habits and ethics. It is expected that individuals having shared prior positive task interaction will most likely form groups together. Thus, previously acquired positive task interaction may result in current stronger group task cohesion through increased initial familiarity with other members' work habits and strengths. As stated earlier, it is likely that individuals who have shared negative task interactions in the past will avoid forming a group together. Cartwright (1968) indicated that a review of the literature revealed that a group member's intention to remain within a group is an important precursor to cohesiveness. Given the fact that groups in the current study must remain intact for the term's duration, it is very likely that most participants will seek to fix group membership for the semester, while optimizing the group's performance potential. Hence, participants will seek others with whom they share previous task interaction and task cohesion with the intention of maximizing group performance potential. It is therefore expected that higher levels of prior task interaction between group members will impact levels of group cohesion. This suggests the following hypothesis:

H3a: Higher levels of prior task interaction will be positively associated with levels of initial group cohesion.

As groups' levels of current task interactions increase, it is expected that the impact of previous task interactions will diminish over time. It is believed that the

discrepancies between the current and previous tasks will result in change in long-term task cohesion. Therefore, current task cohesion will likely be affected more by current task interactions between group members than by past task interactions. This suggests that:

H3b: The positive association between higher levels of prior task interaction and levels of group cohesion will diminish over time.

Many researchers report the data examining the cohesion–performance link to be inconclusive (Mudrack, 1989b; Stogdill, 1972). Meta-analyses have failed to provide clear insight into the nature of the relationship between both constructs (Evans & Dion, 1991). These findings are perhaps due to the use of a variety of operationalizations and measures. However, some specific studies report a positive relationship between cohesiveness and performance (Dorfman & Stephan, 1984). In addition, Gully et al. (1995) revealed that the link between cohesion and performance is stronger when measured at the group level in comparison to the individual level. Therefore, it is expected that:

H4a: There will be a positive association between cohesiveness and performance.

Similar to the effects of upward efficacy spirals, it is hypothesized that cohesion will increase as subsequent high performance yields higher levels of cohesion. Mullen and Copper's (1994) findings suggest the relationship between cohesiveness and performance changes over time. The recurring interaction between both variables is believed to alter the magnitude of the positive relationship. Although some studies reveal no changes in cohesion occur over time (Chang & Bordia, 2001), these studies often measure cohesion and indicators of group effectiveness only twice. Therefore, Mullen and Copper's findings demonstrating that high group performance

leads to higher subsequent levels of cohesion can only be verified if both constructs are measured multiple times over a longer period of time. This suggests that:

H4b: The positive association between group cohesiveness and performance will increase in strength over time.

The longitudinal nature of this study results in the generation of multiple measurements of both the cohesion and performance variables. It is plausible that the influence of one measurement period on subsequent periods will diminish as more recent member interaction will have a greater impact on the relationship. It is possible that group events occurring during the interval between measurements has an impact on the strength of the association between group cohesion and performance. It is likely that the positive association between group cohesiveness at time N and group performance at time N+2, N+3, N+4, and so forth will decrease. This means that the greater the time span between the measurement of cohesion and the measurement of performance, the lower the association between the two constructs. Therefore, it is expected that:

H4c: The positive association between levels of group cohesion and performance will diminish as the temporal interval between cohesion and performance measurements increases.

Methods

Sample

Data for this study was obtained within the context of a business simulation conducted as part of the COMM 401 Strategy and Competition course at the John Molson School of Business (JMSB). This course is a required class for all JMSB students. The simulation started in the fourth week of the course and finished 10 weeks later, at the end of the course. There were 429 students enrolled in 11 different

sections at the beginning of the term and 412 students completed the entire term. The mean age of participants was 24.2 years, and 52.9% were female. The 11 different sections of the same course were taught by seven instructors. Students received 5% of their course grade for participating in the 10-week study and completing all 10 online surveys associated with the study. Students lost 1% for each missed survey. However, participation in the study was voluntary and students who did not wish to participate were offered an alternative written assignment for an equivalent 5% grade. One student opted to complete the alternative assignment. The 17 students who dropped the class during the term were removed from the study.

Task

The hypotheses were tested within the context of a computerized business simulation. Past researchers have used simulations and games to estimate the directionality and magnitude of the cohesion–performance relationship (Dorfman & Stephan, 1984). *The Business Strategy Game: A Global Industry Simulation* (Thompson & Stappenbeck, 2002) was used in the current study. The Business Strategy Game (BSG) is a strategic management simulation. It is an educational tool that requires groups of students to make decisions about a number of functional and operational competitive decisions relating to the managing of a fictitious athletic footwear company.

All groups began the BSG simulation operating identical athletic footwear companies. In this study, students formed 109 different companies (groups) consisting of two to five students. Each company was assigned a letter and an industry number. The group letters ranged from A to G. Each industry was assigned a number, ranging from 71 to 86. An "industry" is thus a group of groups and is the competitive environment in which each group operates. There were 16 industries in which six or

seven groups competed against each other. All 16 industries were composed of groups from different sections of the course. This may sound a bit complex but in practice it was actually a rather simple structure.

The following example should help explain the group and industry structure. Group 71A consisted of four students from the same course section. As the number indicates, this group competed in Industry 71, which included six other groups (groups 71B through 71G). The simulation used the decisions from the se seven groups to determine the weekly results for that industry. Industry 72 also consisted of seven groups (72A through 72G) who competed against each other. Each of the student groups in Industry 71 was from a different section. This structure ensured that no two groups within a single section competed against each other. Thus, group 71B was in the same section as group 72B, but the two companies did not compete against each other.

Student groups operating the athletic footwear companies were required to electronically submit a set of 119 decisions in a single attached file to BSG administrators on a pre-set strict weekly deadline, every Wednesday at 5 PM for the duration of the simulation. Each company's decision file was then processed with the decision file from the other companies in the same industry. Using the decisions about sales, financing, operations, marketing, and human resources, the simulation generated weekly performance results for each company. Each company then received its individual results via e-mail. These included sales, revenue, and marketing performance outcomes for the firm, and an industry report was also included. The outcomes for each round determined the conditions for decisions in the next round. An industry report, which detailed every other company's performance

indicators, was included with the company results. The results of each round were e-mailed to the groups every Wednesday evening.

The distribution of performance indicators for all companies within a given industry permitted an objective comparison of the previous week's performance levels against other companies in the same industry. The performance results were figured cumulatively such that performance levels during one week affected performance data in subsequent weeks.

Table 1 depicts the BSG schedule and the distribution of the various scales used in the weekly online surveys. Informed consent forms were available via a website dedicated to the BSG research project. The BSG simulation and surveys were conducted across a period of 12 weeks. The schedule included two pre- and post-BSG data-gathering weeks (weeks 1 and 10) and one practice round (week 2). The group-performance data was collected during the seven BSG decision rounds (weeks 3, 4, and 7 through 11). Weeks 5 and 6 coincided with the course mid-term assignment and spring break. No BSG decisions were due nor were any surveys conducted during these 2 weeks. Thus, there was a 2-week break between the second and third set of decisions required for the BSG simulation.

Procedure

On the first day of class in all sections of the course, one of two researchers for this study attended the class. Researchers provided the students were provided with a description of the BSG simulation as well as the research study. This presentation was integrated as part of the course introduction by the section instructor. The researchers also answered any questions about the simulation and the study. Students were notified that, as specified in the course outline, the actual *performance* in the BSG simulation would have no impact on the group project grade. However,

participation in the business simulation was a required part of the course, worth 25% of their course grade. Upon completion of the simulation, each group submitted a written report on its company's performance and that report, graded by the instructor for the group's section, determined the grade for that group. As noted above, participation in the study was voluntary and potentially worth 5% of a student's course grade, providing all 10 surveys were submitted on time. While each instructor included the BSG schedule within the course outline, students were not informed of the specific ending round for the simulation. Rather, they were told the duration of the BSG would range between five and eight rounds. This was done to avoid possible end-game aggressive business strategies.

Following explanation of the BSG, the research component of the BSG simulation was described. The research in this study was based on 10 online surveys. Surveys were submitted on a weekly basis and varied in length. The surveys were collected through the following website: www.riskstrategy.org. This website was maintained by Dr. Martin L. Martens, the course coordinator and one of the researchers involved in this study. Consent forms containing important information about the research were also available to participants on this website (Appendix A). The contents of the 10 surveys changed each week and each survey had a unique colour background and layout. Table 1 lists the schedule of the measures used in this study. The introduction of the BSG and the research study during the first class was followed by 2 weeks during which groups were formed, and students became familiar with the business simulation. The first survey occurred in the third week of the class. To help the students become familiar with the simulation, a BSG practice round was conducted in the fourth week. The first round of the simulation started in the fifth week, and the seventh and final round occurred in the 13th week of the class, two

weeks before the end of the course. As previously mentioned, during term weeks 7 and 8, no BSG activity occurred as these weeks coincided with a mid-term examination period and spring break.

Table 1

Schedule of Measures and Surveys

Term Week	3	4	5	6	9	10	11	12	13
Date	21 Jan	28 Jan	4 Feb	11 Feb	4 Mar	11 Mar	18 Mar	25 Mar	1 Apr
BSG Round		PR	1	2	3	4	5	6	7
Demographics	x								
Prior Simulation Experience	x								
Social Desirability	x								
Prior Interaction		x							
Group Formation		x							
Group Cohesion			x	x	x	x	x	x	x
Performance Feedback		x	x	x	x	x	x	x	x

As this study was part of a larger group of studies, the weekly surveys included a number of other measures that are not used in the current study. The measures used in this thesis are described below and the items for these measures are attached as appendices. The measures included in the surveys but not used in this thesis are listed at the end of this section.

The main page on the survey website (www.riskstrategy.org/bsg/survey.html) contained a list of the 10 surveys and the scheduled completion dates for each survey. A link was activated for the weekly survey during the specific scheduled dates for each survey. The course syllabus contained the web address of the main survey page, and students received weekly reminders for the surveys when they received the results of each BSG round. The links to surveys 2 through 9 were activated following the distribution of the performance results of each round on Wednesday evenings. The participants were instructed to complete the surveys individually and not as a group, prior to working on the following week's set of decisions. The links were active between Thursdays and Mondays during the simulation. During this period, each

Saturday the names of the students who had completed the survey were collected from the website by the researchers. One of two e-mail notices was then sent to all participants in the study. Students who completed the survey for that week received an e-mail acknowledging receipt of their participation; students who had not yet completed the survey received a reminder e-mail. The two reminders were very effective in encouraging student participation.

On the following Monday, the database was examined for students who had not yet completed the survey. These participants were sent a final notice and reminder that missing a survey meant students could potentially lose 1% of their course grade. Table 2 contains the participation rate on all 10 surveys for the 412 students who remained in the course for the duration of the study. The 20 students who completed some of the initial surveys but dropped out of the course were deleted from the study. Survey 8 had the largest number of missing students (12). As all variables in this study are group-level variables and no groups had data missing from more than one group member in any single survey, the available data is used to calculate the group-level value. If a group had missing data from one member during the week, the group-level value was calculated using the data from the group members who did respond.

Table 2

Survey Participation Rates

Survey 1	Survey 2	Survey 3	Survey 4	Survey 5	Survey 6	Survey 7	Survey 8	Survey 9	Survey 10
100%	99.5%	100%	99.5%	100%	98.8%	99.3%	97.1%	98.3%	97.6%

Although the results of the simulation were not used to determine the project grade, the students were informed before the commencement of the study that the group finishing first in its industry would receive an interesting and worthwhile prize. At the end of the term, movie tickets were distributed to each student in the winning groups. Students were informed at the beginning of the term that participating actively

in the BSG would facilitate the writing process for the final group project. Prior to the data-gathering period, participants were also informed of a bankruptcy cap, believed to encourage groups to make sound financial decisions. Participants were informed that bankruptcy would be possible as of Round 5, and could make the writing process for the final report more challenging.

Independent Variables

Group-formation method. Group formation is defined as the reason for which members of a given group opt to form a group together. Instructors were asked to allow students to form their own groups and all sections of the course used this procedure. Therefore, participants were not assigned to groups by either the researchers or the instructors. Hence, groups were considered *naturally formed.* In Survey 2, participants were asked to select from a descriptive list the manner that most fits the way in which their group was formed. Participants were also permitted to provide additional comments on the group-formation method. The variable is a categorical measure with values from 1 to 5 to capture the description of how groups were formed. A value of 1 indicates that the members of the group scheduled themselves into the same class with the express intent of working together on the course-related group project. Table 3 indicates the distribution of responses for each categorical description of method of group formation. A value of 5 indicates that group members were the stragglers who formed a group because they were unable to individually find another group. There was also a comment box in which participants could provide additional information on the method of group formation. The value on the group-formation scale was altered, based on their comments. However, only five individuals used the comment box to clarify the manner in which their group was formed.

Table 3

Response Distribution of Categories of Group Formation Method

Category	Category Description	N	% of Responses	Item
1	Friends	5	4.7%	All of the members of my group and I purposely registered for the same section of the course so we could work together
2	Friends & Acquaintances	6	5.7%	Some members of my group purposely registered for the same section of the course so they could work together and others joined the group.
3	Acquaintances	32	30.2%	When teams were formed, members of my team and I were sitting in the same area of the class but we knew each other prior to this class.
4	Convenient	46	43.4%	When teams were formed, members of my team and were sitting in the same area of the class but we did not know each other before this class.
5	Stragglers	17	16.0%	When teams were formed, my teammates and I worked together because other students had already formed their teams and we had no other choices.
		106		

Previous social and task interaction. While some groups in the study were composed of some or all students with shared prior social or task interaction, other groups were formed by students who had not shared prior interaction. To assess the level of total prior interaction among members in the group, each participant rated the amount of prior social and task interaction shared with each other member in their group (Appendix B). This assessment was conducted in Survey 2, after the practice round. The 5-point scale ranged from no prior interaction, which received a score of 0 (zero), to "a lot" of interaction, which received a score of 5. The sum total of all ratings was divided by the total number of group members to create the group score. Higher scores thus indicate higher levels of prior interaction.

Group cohesion. This study used the Dobbins and Zaccaro's (1986) eight-item group cohesion scale (Appendix C). This measure assesses group members' perceived level of cohesiveness. The 7-point Likert scale was anchored by strongly disagree/strongly agree. The group cohesion scale was included in seven surveys,

starting after the performance results for Round 1 were sent to the students. Cohesiveness was assessed after each round until the last week of the simulation, Round 7. Measurement for cohesion occurred following the distribution of the weekly BSG results by the BSG administrators. Each item was slightly modified on the original scale to adapt it to the present group context. To limit participants' familiarity with the scale, items from the cohesion scale were interspersed with items from various other scales each week. All questions were randomly arranged within the weekly survey. Additionally, slight modifications were made to the online questionnaires' layout and colour scheme each week. To further reduce any possible familiarity bias with the use of repeated measures, the surveys used phrasing asking the participants to consider the conditions over the last round only (e.g., For the last BSG round, the members of my group got along well together). Cronbach's alpha values for each of the group cohesion scales used in post-round 1 through to post-round 7 are 0.88, 0.88, 0.90, 0.91, 0.90, 0.93, and 0.93.

The average r_{wg} across all groups ranged from 0.877 to 0.991 with an overall average r_{wg} of 0.931. These values indicate a very high level of inter-rater agreement within the groups. The total score for all participants was averaged for each group to obtain the group-level value used in the regression models.

The results of the factor analysis for the group cohesion scale are presented below in Table 4. All factor loading values were greater than 0.40; therefore, item 3 was moderate, whereas the remaining seven items with values above 0.60 were strong.

Table 4

Factor Analysis of Group Cohesion Scale Items

Group Cohesion Scale Items	Factor Loadings
1. Considering the last BSG round, if given the chance, I would choose to leave my group and join another.	-0.773741
2. For the last BSG round, the members of my group got along well together.	-0.744014
3. During the last BSG round, the members of my group would have readily defended each other from criticism by outsiders.	-0.521522
4. During the last BSG round, I felt that I was really a part of my group	-0.701519
5. In the last week, I looked forward to being with the members of my group.	-0.761359
6. During the last BSG round, I found that I generally did not get along with the other members of my group.	-0.726831
7. During the last BSG round, I enjoyed belonging to this group because I was friends with my group members.	-0.642443
8. During the last BSG round, the group to which I belong was a close one.	-0.686814

Group performance and performance feedback. Throughout the duration of the study, each group received computer-generated results from the BSG simulation software indicating the within-industry score for that week and a game-to-date within-industry score. Group performance was assessed at the end of each round. Using the results from the companies' decisions file, the game administrators used the BSG software to calculate a score ranging from 0 (zero) to 100, which ranked each company within a specific industry. The simulation software provided the score by combining the weighted results of the company revenues, sales, earnings per share, debt rating, stock performance, and strategy rating. The weekly and cumulative scores permitted members of one company to compare their performance with other companies in their specific industry. The weekly performance files also reported the change from the previous week for both that week's and the game-to-date score. These values were also indicative of performance and sources of feedback. The game-to-date (GTD) score for each round was the dependent variable used in this study.

Control Variables

Social desirability. The score on a social desirability scale is an indicator of how likely it is that a respondent is giving socially desirable responses, rather than an honest and personal response. The social desirability scale included in the first survey was the 10-item short version of the Marlowe-Crowne's scale (Strahan & Gerbasi, 1972; Appendix D). To create a group-level score, the individual responses were averaged for each group. A higher average on the group-level score indicated that more participants within the group were possibly altering their responses to conform to what they thought was appropriate for the situation. This control measure was included to reduce the potential effect of participants providing socially desirable responses to the cohesion scale.

Group Mean GPA. This variable is the average grade point average (GPA) among the participants in each group. This variable was included to control for the possibility that GPA is a relevant measure of student performance and that students with higher GPAs, and therefore groups with members who have higher GPAs, on average, are more motivated and likely to perform better in the BSG simulation.

Instructors 2 through 7. This variable was included to control for potential differences among the various sections. Although all instructors were provided the same information about the BSG, some instructors were more familiar with the simulation. Additionally, other instructors may have spent more time during the class discussing the simulation, or providing more out-of-class help to the student groups. The comparison for the controls is to Instructor 1, thesis advisor Martin L. Martens, who taught one of the sections included in this study. Instructor 1 was most familiar with the BSG of all instructors, and could likely monitor more closely information about the BSG offered to participants enrolled in his section. An ANOVA showed

that the groups in the section taught by Instructor 1 generally had the lowest average weekly BSG scores, although this result was not significant across BSG rounds among instructors.

Prior simulation experience. This variable was included to control for the possibility that prior experience with computer simulations in classes may provide an advantage. This was a dichotomous variable where 1 (one) indicates that one or more members of a group have had prior simulation experience and a 0 (zero) indicates that no member of a group has had prior simulation experience.

As noted earlier, this research was part of a larger study involving a number of other research projects that used a variety of other scales included in the 10 weekly surveys. The other scales used include the following: Cognitive style inventory (Allinson & Hayes, 1996); locus of control scale (Rotter, 1966); achievement motivation questionnaire (Sagie, 1994); risk assessment scale (Martens & Hofmann, 2001); group efficacy questionnaire (Pethe, 2002); group conflict and conflict resolution scales (Jehn, 1995); goal commitment scale (Hollenbeck et al. 1989); intolerance for ambiguity (Budner, 1962); individualism/collectivism scale (Wagner & Moch, 1986); Dorfman cultural questionnaire (Clugston, Howell, & Dorfman, 2000); risky decision scale (Barringer & Bluedorn 1999); and the autonomous motivation scale (Gagne, 2005). The group conflict, conflict resolution, and group efficacy scales were repeated in all surveys assessing group cohesion scale. All other scales were included in only one survey.

Model Tested in this Study

The model used in this study is based upon Mullen and Copper's (1994) narrative review on the two primary methods used to explore the cohesiveness–performance relationship. The associational method allows groups to naturally

develop, and requires investigators to measure the level of cohesiveness as perceived by group members. In using this paradigm, the current study permitted the investigation of the role that group-formation methods play in the cohesiveness–performance link. The notion of prior social and task interaction was also integrated in the study to test the hypotheses relating to the influence that prior task and social interaction between group members may have on group formation methods.

The use of associational methods introduces the problem of directionality regarding the relationship between both variables, which requires further empirical investigation. This study sought to clarify the directionality of the cohesion–performance relationship by investigating two models: cohesion as a predictor of performance (cohesion–performance) and performance as a predictor of cohesion (performance–cohesion). Ordinary Least Squares (OLS) hierarchical regression analyses were used for all of the models in this study. Cross-lagged panel data regression analysis static models (Halaby, 2004) were used to improve the strength of the causal inferences needed to investigate the directionality of the cohesion–performance association. Regression diagnostics were employed to monitor problems such as multicollinearity, skewness, non-normality of residuals, and other regression model assumption violations. No consistent problems developed in the diagnostics and all models were used without variable transformation. However, because of the strong correlations and possible multicollinearity problems between group-formation method and prior social and task interaction, the group-formation variable was removed in the models testing the effect of prior social and task interaction and returned in the subsequent models. Although there were high correlations between some of the variables, the results from regression diagnostics used on all models did not indicate any multicollinearity problems in the models containing all variables.

Results

Table 14 (Appendix E) provides the descriptive statistics and correlations for all variables. A few items from this data are worth discussing. The first noteworthy item is that the average level of group cohesion is remarkably stable. The average across all rounds in the simulation is 44.88 (out of a possible score range of 8 to 54 for this measure) and the per-round average does not change more than ±0.45. The average per-round score on the simulation starts at 65 and drops to 54 by the fourth round and remains close to that level. This suggests that there is a fairly high level of cohesion reported by the groups. As well, the level of cohesiveness remains fairly constant, even after the average performance decreases. The second noteworthy item is the correlations among the cohesion results for each round. These are consistently high, ranging from 0.68 to 0.92, generally decreasing as the time span between two cohesion measures increases. On average, a cohesion measure from one round to the next has a very high correlation of 0.89. However, this correlation steadily decreases over time. Thus, the level of group cohesion may be fairly stable from one round to the next but does not perfectly predict levels of cohesion four or five rounds later. This suggests that the level of group cohesion does change fairly quickly across time. As well, the timing for the measure may have an effect on the results of the study, particularly if cohesion is measured at the start and performance is measured at the end of a study.

All OLS regression models are contained in models 1 through 92. However, due to the size of Tables 14–26, they are located in Appendix E. To simplify the analyses and the comparisons across rounds, the following sections will incorporate summary tables of the change in ΔR^2 for the models relevant to each of the hypotheses.

Table 5 provides the summarized results of the regression analyses for all control variables. Analyses were conducted in accordance with both group cohesion–performance and performance–cohesion models. Group size did not have an effect on group cohesion or performance in either of the proposed models. Of the seven instructors for the 11 sections of the course, only one consistently had an effect on group performance in comparison to groups whose members were enrolled in other sections of the course. This effect was compounded in the last weeks of the BSG.

Table 5

Summary of the ΔR^2 OLS Regression Analyses for Control Variables in both Group Cohesion–Performance Models

		Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7
			Model 65	Model 67	Model 70	Model 74	Model 79	Model 85
Cohesion→ Performance	ΔR^2		0.0%	2.1%	3.7%	2.0%	0.1%	1.6%
		Model 1	Model 7	Model 14	Model 22	Model 31	Model 41	Model 52
Performance → Cohesion	ΔR^2	7.8%	4.8%	6.9%	8.2%	12.2%	5.7%	7.3%

One of the instructor control variables, Instructor 7, is significantly and positively associated with performance in many of the models, especially in the models predicting performance. Interviews with the instructor indicated that, compared to other instructors, this instructor spent more time in class discussing the simulation and how groups might be able to improve their performance in the simulation, providing a potential explanation for this result. In a few of the models, the control variable for Instructor 6 has a significant positive association with performance. However, this effect is not consistent across rounds.

In the models examining only the control variables, mean group GPA is the only variable that is consistently and significantly associated with both cohesiveness and performance across all rounds. Table 6 shows the results, which indicate that

mean group member GPA has a greater effect on group cohesion than on group performance. These results may be accounted for by a few possible explanations. Firstly, higher average GPA in the groups may be a proxy for greater motivation among the group members to do well. Secondly, considering group projects are a required element in many JMSB business courses, students with higher GPAs may have developed the skills necessary to perform well in groups, including the ability to work well with other students. This may translate into the ability to identify and create the conditions necessary for a cohesive group. Thirdly, the positive association between average GPA and cohesion is more consistent and stronger than the association between average GPA and performance. Considering the consistent and positive association between cohesion and performance, the result presented in Table 6 suggests that cohesion mediates the relationship between average GPA and performance, leading to the following model: Average group GPA +→ Cohesion +→ Performance.

Table 6

Summary of OLS Regression Analysis for Average Group Member GPA

	Post–Round 1	Post–Round 2	Post–Round 3	Post–Round 4	Post–Round 5	Post–Round 6	Post–Round 7
Cohesion *b*	0.053	0.015*	0.004*	0.001*	0.001*	0.008†	0.029*
	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7
Performance *b*		0.052	0.009*	0.014*	0.024*	0.068	0.142

An asterisk (*) denotes an effect significant at the <.05 level.

In the regression analyses examining the effect of group-formation method on group cohesion, the comparisons among categories 2 to 5 and category 1 indicate that group formation methods differ in their effects on group cohesion across all seven rounds, providing strong support for Hypothesis 1. The results in Table 7 and Figure 1 below indicate that this effect is fairly consistent across all rounds in the BSG.

Table 7

Mean Group Cohesion Values for Categories of Methods of Group Formation

Category		Post-round 1	Post-round 2	Post-round 3	Post-round 4	Post-round 5	Post-round 6	Post-round 7
1	Friends	50.6	51.3	51.7	51.4	51.0	52.2	51.5
2	Friends & Acquaintances	47.1	46.3	48.0	47.4	47.0	46.2	48.9
3	Acquaintances	46.8	46.5	46.4	46.6	47.5	46.3	47.6
4	Convenient	42.7	42.7	43.9	43.3	43.0	42.7	42.9
5	Stragglers	43.8	45.2	44.3	43.0	42.1	42.3	43.2
	ANOVA Results (df 4,101)							
	F-Ratio	137.62	129.29	99.52	129.07	180.35	159.96	196.46
	p value	0.001	0.001	0.001	0.001	0.001	0.001	0.001

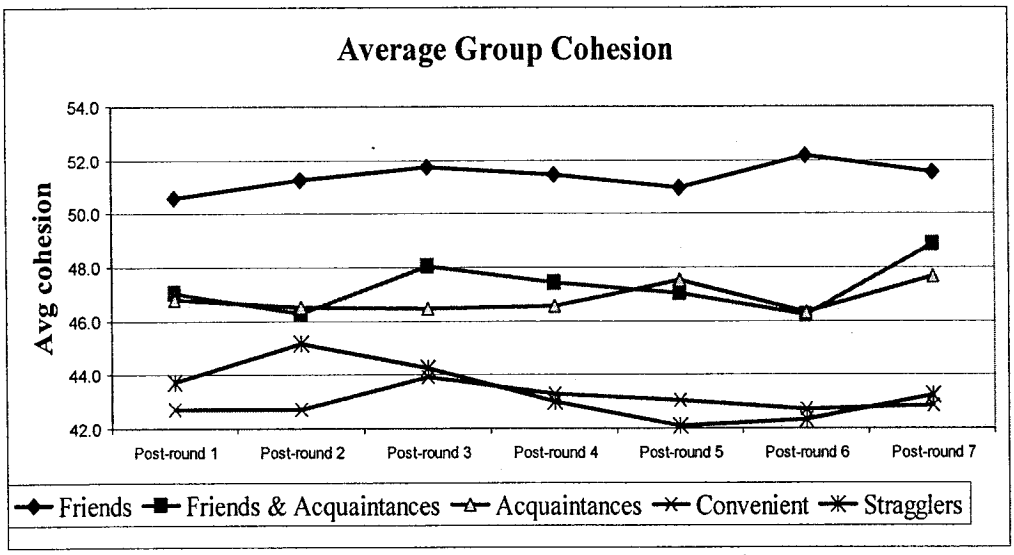

Figure 1. Mean Group Cohesion Values for Categories of Methods of Group Formation over 7 rounds of the BSG

The regression analyses examining the effect of group-formation method on group performance in Table 8 indicate that group formation methods may have differential effects on group performance across all seven rounds, though these differences are not statistically significant. While no hypothesis was formulated with regard to the effect of methods of group formation on performance, some interesting findings are noteworthy. For example, it is apparent in Figure 2 that initial

performance levels are highest for groups formed of *stragglers* (Category 5) rather than individuals who had enrolled in the course with the intention of working together (Category 1). The results in Table 8 and Figure 2 below indicate that this effect is fairly consistent across all rounds in the business simulation.

Table 8

Mean Group Cohesion Values for Categories of Methods of Group Formation

Average Group Performance Score for Each Category								
Category		Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7
1	Friends	63.6	70.2	66.4	62.2	62.6	64.4	65.8
2	Friends & Acquaintances	70.0	73.7	67.5	52.7	63.2	54.8	52.5
3	Acquaintances	66.0	65.4	64.0	62.9	62.7	60.3	57.8
4	Convenient	61.3	59.8	55.3	48.7	52.3	54.5	52.5
5	Stragglers	75.6	70.7	63.3	54.4	50.4	52.3	50.7
	ANOVA Results (*df* 4,101)							
	F-Ratio	676.50	585.30	565.42	1031.30	776.32	314.47	356.18
	p value	0.15	0.33	0.43	0.24	0.39	0.81	0.80

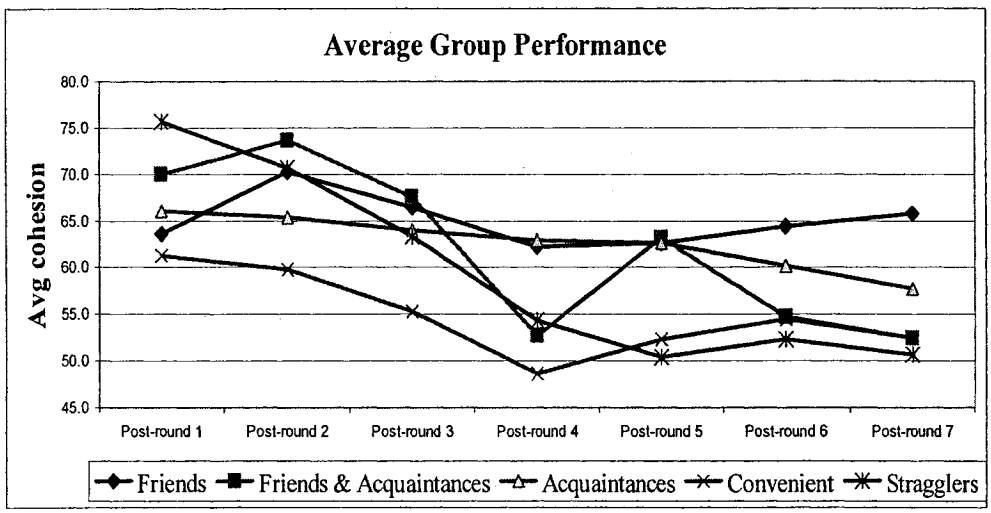

Figure 2. Mean Group Performance for Categories of Methods of Group Formation over 7 Rounds of the BSG

Therefore, the findings on the effects of group formation methods provide evidence to support the claim that the method used to create the group has a significant and lasting effect on group cohesion across the entire simulation. This

result points to a potentially serious flaw in previous cohesion studies. More precisely, studies generally describing *naturally forming* groups, or using random assignment to form groups, have failed to integrate measures for assessing how the group was formed. Consequently, these studies lack crucial information on a key variable that has considerable influence on levels of group cohesion.

In Table 9 below, the results of the effects of adding prior social interaction and prior task interaction into the models across all seven rounds are presented. The results reported for prior social and prior task interaction indicate the additional effect of adding just one of the two variables. The models used to calculate these results included the control variables but did not include the effect of group formation. The results in Table 9 provide support for Hypothesis 2a but not 2b, and display a constant positive association between prior social interaction and cohesion, which appears to diminish slightly over time.

The results in Table 9 also show a significant association between prior task interaction between group members and levels of group cohesiveness. These results suggest that while prior task interaction was positively associated with group cohesion, the effect peaked during Round 2 and decreased thereafter. However, prior task interaction did not have the strongest association with initial (Round 1) group cohesiveness levels. Hence, Hypothesis 3a was partially supported as the effect of prior task interaction does decrease from earlier rounds but only after the second round. In addition, the decrease in the effect of prior task interaction on group cohesion partially supports Hypothesis 3b as the effect does decline, although it is not a significant decline.

These results, however, only occur in models where prior task interaction is included without the prior social interaction variable. The correlation between these

two variables is 0.89 ($p<0.001$), indicating that both variables are similar. The results change considerably when they are combined in models where both variables are included. In these models, only the prior social interaction variable remains consistently significant in the expected direction, while the prior task interaction variable is not significant in most models. Interestingly, in the one model where prior task interaction is significant, the coefficient is negative. Tests for collinearity between both constructs were negative; however, the high correlation between both variables could indicate a suppression effect. In two models, the p-value is close to the 0.10 cutoff and the coefficients are also negative. These results suggest that prior task interaction, after controlling for prior social interaction, may be negatively associated with group cohesion. The results of the analyses provide strong support for Hypothesis 2a, partial support for Hypothesis 2b, and do not support Hypotheses 3a and 3b.

Table 9

Summary of ΔR^2 in OLS Analyses Models

	Post–Round 1	Post–Round 2	Post–Round 3	Post–Round 4	Post–Round 5	Post–Round 6	Post–Round 7
	Model 3	Model 9	Model 16	Model 24	Model 33	Model 43	Model 54
Prior Social Interaction	11%	12%	7%	9%	11%	8%	9%
	Model 4	Model 10	Model 17	Model 25	Model 34	Model 44	Model 55
Prior Task Interaction	9.3%	9%	7%	6%	11%	7%	9%

Tables 10 and 11 below provide the results of the OLS analyses comparing all cohesion–performance associations where a prior measure of cohesiveness exists for a subsequent measure of performance. Considering that the first cohesion measure was included in the survey following Round 1 and that the post–Round 1 cohesion result was obtained prior to all subsequent rounds, the measure may be used to predict the performance in subsequent rounds. These panel data analyses may be used to draw causal inferences about the relationship between cohesion and performance.

Table 10

Summary of ΔR^2 OLS Analysis of Cohesion → Performance Models

		Performance					
		Round 2	Round 3	Round 4	Round 5	Round 6	Round 7
Cohesion		Model 66	Model 68	Model 71	Model 75	Model 80	Model 86
	Post–Round 1	1.2%	-1.9%	2.3%	3.6%	0.8%	-0.5%
			Model 69	Model 72	Model 76	Model 81	Model 87
	Post–Round 2		3.3%	7.7%	9.1%	3.5%	1.3%
				Model 73	Model 77	Model 82	Model 88
	Post–Round 3			11.0%	11.7%	6.6%	3.6%
					Model 78	Model 83	Model 89
	Post–Round 4				12.0%	8.4%	3.2%
						Model 84	Model 90
	Post–Round 5					6.4%	2.5%
							Model 91
	Post–Round 6						7.4%

The results shown in Table 10 indicate that cohesion at the start of the simulation does not account for a significant amount of performance. The effect of cohesiveness on performance increased progressively during the first four measurements, peaking during Round 5 of the BSG (ΔR^2 = 12.0%). Cohesion remained below these values during the following 2 weeks. Table 11 indicates similar results. In all but Round 1, initial performance accounts for the greatest amount of variance in group cohesion. The highest association between the two constructs is apparent when Round 2 and Round 4 performances have the greatest effects on post–Round 2 and Round 4 group cohesiveness. Together, the results in Tables 10 and 11 provide strong support for Hypothesis 4a, as both models show a positive association between cohesiveness and performance. However, the association between cohesion and performance tends to be the strongest when they are measured closely together. This observation holds true whether the cohesion-predicts-performance or performance-predicts-cohesion model is used. Therefore, Hypothesis 4b is not supported, as the association decreases in strength over time.

Table 11

Summary of ΔR^2 OLS Analysis of Performance → Cohesion Models

		Cohesion						
		Post–Round 1	Post–Round 2	Post–Round 3	Post–Round 4	Post–Round 5	Post–Round 6	Post–Round 7
Performance		Model 6	Model 12	Model 19	Model 27	Model 36	Model 46	Model 57
	Round 1	0.9%	3%	1%	1%	1%	0.5%	0.0%
			Model 13	Model 20	Model 28	Model 37	Model 47	Model 58
	Round 2		8%	13%	5.7%	4%	5.2%	5.4%
				Model 21	Model 29	Model 38	Model 48	Model 59
	Round 3			7%	5.9%	3%	4.3%	3.7
					Model 30	Model 39	Model 49	Model 60
	Round 4				9%	5%	5.8%	6%
						Model 40	Model 50	Model 61
	Round 5					6%	7.5%	6.5%
							Model 51	Model 62
	Round 6						7.6%	8.3%
								Model 63
	Round 7							11.3%

The analyses reported in Table 12 indicate that as the temporal intervals between measurement of group performance and group cohesiveness increase, the positive association between the two constructs diminishes. According to these findings, cohesion at time one should correlate more strongly with performance at time one or two than performance at time six or seven.

Table 12

Average ΔR^2 for Cohesion–Performance Models Over Time

	Average ΔR^2	
	Cohesion → Performance	Performance → Cohesion
Same Round	6.88% (n=6)	7.11% (n=7)
Round +1	5.68% (n=5)	7.12% (n=6)
Round +2	5.30% (n=4)	4.80% (n=5)
Round +3	3.57% (n=3)	3.83% (n=4)
Round +4	1.05% (n=2)	3.30% (n=3)
Round +5	-0.50% (n=1)	2.95% (n=2)
Round +6		0.00% (n=1)

While both models indicate the same trend, the results shown in Tables 12 suggest that the performance → cohesion model exhibits the greatest decrease in

association over time, though this association remains stronger over time than the cohesion → performance model. These findings provide consistent support for Hypothesis 4c.

The results in these tables provide some noteworthy outcomes. Firstly, the confusion present in the literature precluded the creation of a firm hypothesis regarding the directionality of the performance–cohesion association (Mullen and Copper, 1994). Yet, the results provided in Tables 10 through 12 show that higher levels of performance leading to higher levels of cohesion yields a stronger effect than cohesion leading to performance. Secondly, the performance → cohesion association was not immediate, requiring a couple of rounds of feedback for stronger effects to occur. The performance → cohesion association increased dramatically after Round 2. This was an unexpected effect and suggests that the groups needed at least a couple of rounds of feedback prior to experiencing the confidence in their group and the situation.

Discussion

The purpose of this study was to explore the following question: What is the nature of the reciprocal relationship between group cohesion and group performance? Comprehending this link required investigating the impact of group formation on the relation between cohesion and performance. In addition, understanding the impact of two other variables of interest, group members' prior social and task interaction, was imperative. The discussion section will contain a review of the hypotheses and an elaboration of the concepts and variables noted above. Table 13 provides a summary of the results of the eight proposed hypotheses.

Table 13

Summary Table of Hypotheses and Results

H1: There will be significant differences in the level of cohesion among the five group formation categories.	Supported
H2a: Higher levels of prior social interaction will be positively associated with levels of group cohesion.	Supported
H2b: The positive association between prior social interaction and group cohesion will be constant across all measurements of group cohesion.	Partially Supported
H3a: Higher levels of prior task interaction will be positively associated with levels of initial group cohesion.	Not Supported
H3b: The positive association between higher levels of prior task interaction and levels of group cohesion will diminish over time.	Not Supported
H4a: There will be a positive association between cohesiveness and performance.	Supported
H4b: The positive association between group cohesiveness and performance will increase in strength across time.	Not Supported
H4c: The positive association between levels of group cohesion and performance will diminish as the temporal interval between cohesion and performance measurements increases.	Supported

Group-Formation Method

One of the main objectives of the present study was to examine the role of group-formation method in levels of group cohesion. Hypothesis 1 predicted that different methods of group-formation will have differential effects on group cohesion and this notion was supported by the results of this study. The statistical results strongly suggest that the relationship between the categorical measure of group-formation method and group cohesion is significant. Thus, the group members' method for forming the group appears to have an important effect on group cohesion. It is not surprising that the manner in which a group's members come to work together is a key factor in subsequent group processes. Methodologically, this finding is indicative of the need to cease reducing group-formation method to its antecedents (Hogg & Turner, 1985). As mentioned earlier, many group dynamics investigators

simply note that groups were naturally forming or they randomly assign individuals to groups, and observe the results.

Consequently, the findings in this study also provide strong support for the proposition that group-formation method is an important variable that should be measured whenever the group cohesion construct is being investigated, particularly in studies using naturally formed groups. The results in studies where groups are formed through random assignment might be similar to the category of *stragglers* used in this study, the category with the lowest level of initial cohesion. Random assignment, however, differs from a group of stragglers in that randomly assigned groups may include participants who know each other or would have worked together in a group given that option. This situation contrasts with a group of stragglers which, by definition, is a group of participants who did not know each other prior to the study. Random assignment to groups may be an effective method of removing the effect that prior experience or personal choices have on the level of cohesion within a group. In an academic context, this may allow instructors to ensure that groups are comparative from their inception, as opposed to some groups being inherently less likely to perform at a higher level.

Within the context of student groups, naturally forming groups containing self-selected members have both positive and negative aspects. Bacon, Stewart, and Silver (1999) claim that one positive aspect of self-selected groups is that they display higher levels of initial cohesion. This allows groups to become productive more quickly. The negative aspects of self-selected groups, according to Bacon et al., are that these groups may be more cohesive initially; however, they are more homogeneous and may lack a diversity of skill sets needed to solve problems. Considering this, Bacon et al. suggest that self-selected groups are better suited to

projects of limited duration. The results of the current study do not support these claims and suggest that dynamics of self-selected groups are more complex. Although all of the groups in the current study were self-selected, there are subcategories to self-selection. An ANOVA of groups in the *friends* category (students who intentionally registered in a class with plans to form a group) show significantly higher initial levels of cohesion compared to groups in *stragglers* category (groups composed of stragglers; post–Round 1 average cohesion levels of 50.6 vs. 43.8, respectively; $F=5.39$; $p<.001$). Interestingly, there is no significant difference among groups in initial performance, although the stragglers had higher performance scores (Round 1 scores of 63 vs. 75 respectively; $F=1.74$; *n.s.*).

Prior Social and Task Interaction

The results of the current study support the idea that prior social interaction among group members is associated with group cohesiveness. This finding is consistent with Lott and Lott (1965) who claimed that attraction to the group and other members may affect levels of group cohesiveness. In this study, participants could rely on previous social interaction to determine with whom they wished to work. It was assumed that only favourable prior social interaction would result in participants working with others with whom they had shared the positive prior social interaction. The parallel between Lott and Lott's (1965) notion of attraction to the group and social interaction can be inferred. In essence, prior positive social interaction could be considered a form of attraction to the group. The results supported this notion, and provide evidence to support the claim that social interaction among members prior to a group's formation is significantly associated with group cohesiveness. Yet, as noted in the discussion above, while prior social interaction is

associated with higher levels of cohesion, it does not translate into better initial performance.

Hypothesis 3a predicting a positive relationship between prior task interaction among group members and initial levels of group cohesiveness was not supported. Prior task interaction was associated with group cohesion during the study, however, only if the effects of prior social interaction were not considered. One possible explanation could be that the task interaction that had occurred in the past was not relevant or helpful in the current task, the BSG simulation. This is consistent with the result in some of the models where, when prior social interaction was controlled, prior task interaction was negatively associated with cohesion. Groups with higher levels of prior task interaction may have tried to apply past experiences and practices that did not work in the new situation. Any resulting conflicts may have reduced group cohesiveness. Investigating this possibility requires the addition of measures of group conflict (Jehn, 1995).

Collectively, the findings from this study regarding group formation and prior social and task interaction are important. They demonstrate that a group's performance may be dependent upon the manner in which the group was formed. The results on prior interaction also offer interesting insight into group dynamics, particularly within student groups. Previous studies conducted on group cohesiveness may have examined prior cohesion among members in a group and not the effect of cohesion within the limits of the study. This is a serious potential confounding effect. However, if the researchers in these studies are only interested in cohesiveness, irrespective of when or why the groups are cohesive, the potential confounding nature of this result diminishes.

In an organizational context, these findings are potentially very useful, given the fact that group-formation method is often based solely on personnel availability or interest in a given project, and not on levels of prior social or task interaction. Should organizations have the luxury of selecting group members based on specific criteria, monitoring levels of prior social and task interaction could yield greater levels of group cohesiveness and performance (see discussion of performance below), thereby giving organizations a competitive edge if the group is a strategic one.

Initial Levels of Cohesiveness

The claim that initial cohesion leads to higher initial productivity is not supported by the results of this study. Therefore, higher levels of initial cohesion do not correlate with higher performance levels. However, higher performance over a couple of rounds of feedback eventually translates into higher cohesion levels. Bacon et al.'s (1999) claims are intuitively appealing. They state that groups in which members choose to be together are predictably more cohesive and more likely to perform well, at least initially. The results of the current study, however, suggest that the cohesion–performance association takes time to develop and that high initial cohesion does not correlate with high initial performance. Also, the strength of the association between group-formation method and cohesion remained fairly consistent throughout the simulation. This suggests that the effects are potentially long-lasting and group self-selection may be better suited to longer-lasting projects rather than those of a shorter duration.

The results of this study lead the author to suggest that groups work on creating small wins and not so much on creating initial cohesion. The finding that initial cohesion fails to predict later performance supports this idea. It is also possible that groups may require fairly strong and unambiguous initial feedback to initiate a

positive cohesion–performance cycle. This also points to a significant weakness in studies that use grades as the performance measure. This measure is generally administered after a substantial period of group performance and does not specifically measure performance of groups early on. As well, investigators are often unaware of the type or amount of performance feedback groups received. Therefore, groups may be receiving very ambiguous performance feedback during the project.

In an organizational context, the findings from the current study indicate that performance feedback for groups working on a long-term project may actually affect levels of cohesion and subsequent performance. Due to the fact that these findings appear to be the first of their kind, it is imperative that future research examine the impact of regular performance feedback on group cohesiveness and levels of performance to gain a better understanding of this potentially critical variable.

Cohesion–Performance Relationship

It is clear in the findings of this study that there is a consistently strong positive association between cohesion and performance, thereby supporting Hypothesis 4a. This finding is consistent with Beal et al.'s (2003) investigation. Although such a conclusion is not surprising considering previous literature addressing the topic, previous investigations gave birth to an important debate about the directionality of this association. Stogdill (1972) proposed that high cohesion leads to high performance. His position that no conclusive arguments could be made for such a relationship highlighted the need for alternative approaches to investigating the link. The two models proposed in the current study to verify the directionality of the cohesion–performance link provided an in-depth look at the relationship between both variables, and generated some interesting findings.

Firstly, both the cohesion-predicts-performance (cohesion → performance) and the performance-predicts-cohesion (performance → cohesion) models are useful tools in understanding the directionality of this relationship. Given the fact that this study examined the longitudinal impact of one variable on another, it was expected that both models would be useful, with one being slightly more significant than the other. The finding that the performance → cohesion model is slightly stronger than the cohesion → performance model introduces some additional methodological considerations, including the need to identify what group dynamic variables could play a role in generating higher group-performance levels.

Secondly, Cartwright (1968) called for additional investigation into the "circular causal systems" of cohesion. Both models proposed in the current study indicate that the association between the two variables decreases over time. This is contrary to Hypothesis 4b. The findings also indicate that cyclical patterns, found in the efficacy literature (e.g., Pethe, 2002), are not applicable to the current investigation.

Finally, the data support the notion that the association between cohesiveness and performance decreases as the interval between measurements of each variable increases. This lends support for Hypothesis 4c. The cohesion → performance model is most useful for examining measurements of both variables within a small time interval of one another. However, the performance → cohesion model indicates a higher association between both constructs at longer measurement intervals. As previously mentioned, the performance → cohesion model explains more of the variance between cohesion and performance longitudinally than the cohesion → performance model. This finding is consistent with Mullen and Copper's (1994) analysis that suggested performance → cohesiveness is the most direct effect.

As a summary of the findings of this study, Figure 3 provides a visual causal model suggested by the results:

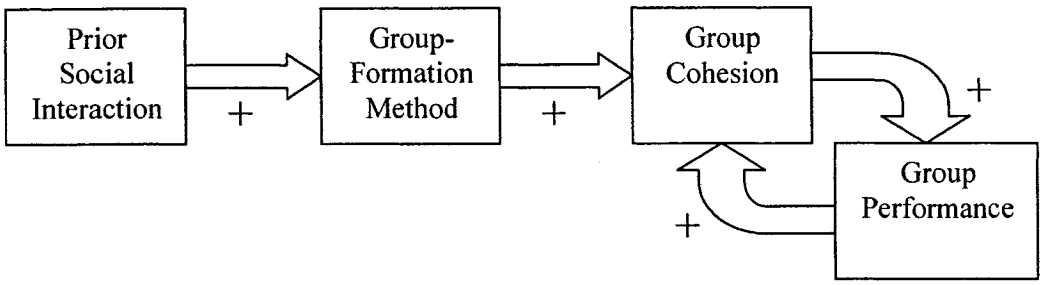

Figure 3. Proposed path-analytic model: Influence of prior social interaction and group-formation method on levels of group cohesion and group performance.

Limitations

The primary limitation of this research is the context in which the study took place—the university classroom. There may be some elements of the research framework that restrict the generalizability of the results. These include, but are not limited to, the age and background of the participants, their position as undergraduate students at a Canadian university, the course in which the study took place, and the simulation used. The results may not be applicable to other types of groups in other settings. For example, sports teams with larger groups may show different effects. It is also possible that long-running groups in businesses have different performance measures and different feedback mechanisms, and may react differently to these types of feedback. The unique multicultural makeup of the Concordia University population may be an important variable not controlled for in this study. Harrison et al. (1998) examined the impact of group diversity on group processes, or more precisely, group social integration. In their research, surface level heterogeneity refers to demographic diversity whereas deep heterogeneity refers to attitudinal divergence between group members. Harrison et al. found that temporal effects both weaken and strengthen

surface- and deep-level diversity, respectively. It is therefore possible that both levels of heterogeneity have differential effects on group processes, including group-formation method and levels of group cohesion.

Another key limitation of the study relates to the timing of the cohesion measurement. The most important timing issue is that group cohesion was assessed for the first time after Round 1 of the BSG. Hence, no baseline measurement for group cohesion was taken prior to the task and social interaction occurring in both the Practice Round and Round 1. A baseline measure was not performed because students were able to drop the course or transfer to different sections at the moment of onset of the BSG simulation. Consequently, groups were not fully set prior to the simulation, and some participants did change group membership during this time period. A baseline measure immediately following group formation might have provided valuable information regarding the pre-simulation cohesion and its development from group inception through to group disbandment. An additional measurement of cohesion prior to groups submitting their final report could have also provided information regarding the stability of group cohesion when task type varies.

Another timing issue relates to the 2-week break between Rounds 2 and 3. The time constraints of the university schedule may have adversely affected some of the cyclical and temporal patterns of the cohesion construct. Group processes may result in systematic group changes while others may be episodic (Arrow et al., 2004). It is possible that one or more episodic changes, usually occurring during early group interactions, could have been affected by this two-week break. It is therefore possible that the data did not capture the effects these changes had on group cohesion and group performance. One final timing issue relates to the finite period of time during which the group members worked together. Unlike many ongoing work groups, the

groups in the current study were disbanded following a 15-week semester. In addition, the course in which the study was conducted is taken during a student's final semester. The odds of future group work with group members are minimal. Therefore, it is possible that levels of cohesion were higher considering participants recognized there was only a relatively short period of time to work with the other group members. However, it is also possible that levels of cohesion were lower since participants may not have wanted to invest in such a short-term relationship. It is also possible that the duration of the study was not sufficient to provide an adequate understanding of the cyclical relationship between the group cohesiveness and group performance constructs.

The single-factor Dobbins and Zaccaro (1986) group cohesion scale was used to assess levels of perceived cohesion. While the scale is composed of items from a number of existing group cohesiveness scales and paradigms, it only effectively assesses social cohesion. In reviewing the literature, it appears that unitary operationalizations and measures of group cohesion are no longer supported by current research. Thus, a different multi-factorial measure may have generated different results. However, researchers have failed to demonstrate the validity and reliability of the Widmeyer et al. (1985) four-factor GEQ. Mudrack (1989a) noted the use of multiple group cohesiveness scales has only contributed to controversy and confusion in the literature. Given the limitations to all existing group cohesion scales, the Dobbins and Zaccaro scale was selected as the best measure. Hence, the group cohesiveness measure used in this study does not follow current recommendations of applying a multi-dimensional paradigm to study cohesion.

The repeated-measures design of the study required participants to repeatedly respond to the same Dobbins and Zaccaro (1986) group cohesion questionnaire. The

10 surveys' style, formatting, and content of items were modified weekly to counteract the effect of participants' familiarity with the recurrent cohesion questions. The use of items from other questionnaires, including the group conflict questionnaire (Jehn, 1995), may have had an effect on cohesion levels. For example, one group noted the weekly surveys were interesting. They noted that some items caused the group members to openly discuss difficult topics relating to the challenges of working in a group. This may be because certain items related to resolution of conflict. As a result, it is possible that some groups used survey items to reflect upon, and alter, their natural work methods and interaction. This in turn may have had an effect on groups' cohesion levels.

There is a substantial amount of disagreement regarding the appropriate level of analysis for cohesion (Zaccaro, 1991). According to Carron (1982), aggregating individual group members' responses implies that all group members are equally important to the group's operations. However, as highlighted by the *groupthink* (Janis, 1982), *free-riding tendency* (Albanese & Van Fleet, 1985), and *social loafing* (Latané, Williams, & Harkins, 1979) literature, individuals within groups have differential impacts on the group's efficiency and productivity. As a result, the unique contribution of each group member is lost when aggregation is conducted, regardless of whether the indicator of within-group variability (r_{wg}) is well above the acceptable cutoff of 0.80 (Moritz & Watson, 1998).

Suggestions for Future Research

The link between goals and performance is a popular area of research. There is evidence demonstrating that goals mediate the effects of cohesion on performance (e.g., Crown & Rosse, 1995). While investigations have focussed mainly on the role individual goals play in performance (Locke & Latham, 1990), a few have examined

the impact group goals may have on group or team performance (e.g., Klein & Mulvey, 1995). Matsui et al. (1987) found that group goal setting has a stronger effect on performance than does individual goal setting. Ambrose and Kulik (1999) conducted a meta-analysis of over 200 studies and noted that there has been a significant trend to incorporate group work into organizational operations. Group goal setting is thus a topic that warrants further investigation in the group cohesion literature. Lott and Lott (1965) used success in reaching group goals to conceptualize cohesion. Carron (1982) also noted that maintaining the "sticking together" tendency during goal pursuance is a key component of group cohesion. These theoretical notions have been applied to a number of empirical studies examining the role group goals play in cohesiveness and performance. Klein and Mulvey (1995) conducted two studies examining the effects of goal processes, such as goal difficulty and commitment, on group performance. Their findings indicate that goals mediate the effects of cohesion on performance. Groups are formed in a variety of settings, and preliminary findings support the relationship between group goals, cohesiveness, and performance. Hence, future studies should integrate goal setting, acceptance, and commitment constructs into investigations focusing on group cohesiveness and performance.

As previously mentioned, using groups in the work environment is gaining in popularity. There is a plethora of work group structures, including virtual work teams and teams that require daily interactions among its members. The range of levels of personal interaction occurring between group members of different group types introduces an interesting variable that presumably has an impact on levels of cohesiveness. Thus, future researchers must consider not only the amount of

interaction, but also the method of interaction, including telephone, e-mail, and personal interaction between group members.

Keyton (2000) maintained investigators must further examine intragroup (dyadic) relationships. The development and impact of these relationships are likely important in a number of group processes, including the development and maintenance of group cohesiveness levels. Keyton also highlighted the fact that little is known on how trust, intimacy, humour, and diversity occur and affect groups. Future investigations integrating any of these variables into a model examining the relationship between cohesiveness and performance may expand upon our current understanding of group dynamics.

Concluding Remarks

Group cohesion is a construct that has received much attention in the research literature. However, the lack of consensus regarding its operationalization is at the root of numerous debates in the literature. The most prevalent sources of discordance revolve around the dimensionality and measurement of the cohesiveness construct. The various paradigms used to investigate group cohesion have also yielded findings that cannot be compared, due to the use of diverging operationalizations, measures and statistical analyses. As a result, the links between group cohesion and other variables, such as group performance, are unclear. There are numerous measures to assess group cohesiveness. One method of eliminating additional confusion is to use existing measures in future empirical studies. The current study used an existing measure to examine the nature of the group cohesion–performance relationship. The results of this study contribute to the cohesion–performance literature in a number of areas.

Firstly, this study investigated the impact of group-formation method and prior interpersonal experience. As many, if not most, cohesion–performance studies simply note that groups were either formed naturally or through random assignment, discovering that group-formation method influences levels of group cohesion is an important contribution. This finding is particularly interesting as the effect is fairly consistent throughout the simulation in the study and does not diminish over time.

Secondly, the data indicating that prior interaction affects group cohesiveness is another important contribution to the literature, particularly because the results point to a clear distinction between prior social and task interaction. For example, social interaction has a positive impact while task interaction may have a negative impact on group cohesiveness.

Thirdly, the methods used in this study permitted a test of the directionality of the cohesion–performance association and the results provide evidence that the performance → cohesion association is generally stronger than the cohesion → performance association. In addition, the results of this study also indicate the association between cohesion and performance diminishes over time and is generally strongest for only a limited period when both are measured close to one another in time.

The findings of this study have yielded interesting insights into the temporal aspects of the relationship between group cohesion and group performance. The particular limitations of the current study and suggestions for future research provide compelling and useful indicators for future investigators who, like the present author, seek to finally provide some cohesion in the group cohesiveness literature.

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Appendix A

Consent Form

CONSENT FORM TO PARTICIPATE IN RESEARCH

(Please print this page and retain it for your own records)

I agree to participate in a program of research being conducted by:
Principal Investigator: Assistant Professor Martin L. Martens, Ph.D.
Co-Investigators: Milly Casey-Campbell; Dr. Kathleen Boies; Dr. Marylène Gagné
Management Department; John Molson School of Business; Concordia University
Phone: (514) 848-2424 ext: 2929; Email: mmartens@jmsb.concordia.ca

PURPOSE The purpose of this study is the investigation of group cognitive similarity and differences and its effect on group performance. It also investigates how individual and group thinking changes over the course of a simulated business decision environment.

PROCEDURES As part of the Business Strategy Game, students will be asked to participate in a research project. Participation in the research is voluntary but participants will receive up to 5% toward their course mark for participating. Grading will be based on complete and timely submission of all surveys. Students who complete all surveys on the assigned dates will receive the full 5%. Late and incomplete submission will lose 1% for each instance. This research requires the completion of a series of short weekly surveys on the internet. These steps should take approximately 2½ hours in total to complete. Detailed instructions will be provided at the beginning of week three and will be posted on http://www.riskstrategy.org/bsg/survey.html.
Students who do not wish to participate in this research may instead choose to write a 3-page paper on a business strategy topic assigned by the instructor. Please notify the instructor by January 17th if you do not wish to participate and would prefer to complete the alternative assignment.
Please inform the instructor before the end of the last class in Week 3 if you do not want to participate in the research and wish to write the paper.

***Confidentiality**: All data will be retained on a secure password protected computer in a password-protected database. Any printed records will be kept in a locked and secure file cabinet. All results will be aggregated beyond the individual and no information about specific participants will be released to anyone not associated with the research program. The web site used for the internet surveys is owned and maintained by Dr. Martin L. Martens. Only the researchers involved with this project will have access to the data collected. Data will be retained for five years after the final article that uses it is published.*

CONDITIONS OF PARTICIPATION

• I understand that I am free to withdraw my consent and discontinue my participation at any time without negative consequences on my course grade. I understand that I may choose to stop my participation at any time and decide to complete the written assignment in its place.

• I understand that my participation in this study is CONFIDENTIAL. The researchers will know but will not disclose my identity.

• I understand that the data from this study may be published.

• I agree to provide my overall GPA and have my project and course grade provided to the principal investigator. I understand that providing this information has no effect on my course mark or the 5% of the course mark assigned to this project.

I HAVE CAREFULLY STUDIED THE ABOVE AND UNDERSTAND THIS AGREEMENT. BY SUBMITTING THE FIRST SURVEY, I AM INDICATING THAT I FREELY CONSENT AND VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY.

If at any time you have questions about your rights as a research participant, please contact: Adela Reid, Research Ethics and Compliance Officer, Concordia University, at (514) 848-2424 x7481 or by email at adela.reid@concordia.ca
The weekly survey deadline is each Friday at 12 noon. To complete the survey please go to

http://www.riskstrategy.org/bsg/survey.html and complete the survey provided for that week. The first survey will be posted by Monday, January 17 and the deadline is Friday, January 21, 2005.

Appendix B

Previous Social and Task Interaction Questionnaire

Previous Social and Task Interaction Questionnaire

1. How much prior social interaction have you had with this group member? (rated for each group member)

2. How much prior task interaction have you had with this group member? (rated for each group member)

Appendix C

Group Cohesiveness Questionnaire
(Dobbins & Zaccaro, 1986)

(Rated using a 7-point Likert scale anchored with strongly disagree and strongly agree)

1. Considering the last BSG round, if given the chance, I would choose to leave my group and join another.
2. For the last BSG round, the members of my group got along well together.
3. During the last BSG round, the members of my group would have readily defended each other from criticism by outsiders.
4. During the last BSG round, I felt that I was really a part of my group.
5. In the last week, I looked forward to being with the members of my group.
6. During the last BSG round, I found that I generally did not get along with the other members of my group.
7. During the last BSG round, I enjoyed belonging to this group because I was friends with my group members.
8. During the last BSG round, the group to which I belong was a close one.

Appendix D

Short Version of Marlowe-Crowne Social Desirability Scale
(Strahan & Gerbasi, 1972)

(Rated using a 2-choice scale with the responses of "yes, this describes me" or "no, this does not describe me")

1. I have never been irritated when people express ideas very different from my own.
2. I have never intensely disliked anyone.
3. There have been times when I was quite jealous of the good fortune of others.
4. I would never think of letting someone else be punished for my mistakes.
5. I sometimes feel resentful when I don't get my way.
6. There have been times when I felt like rebelling against people in authority even though I knew they were right.
7. I am always courteous, even to people who are disagreeable.
8. When I don't know something I don't at all mind admitting it.
9. I can remember "playing sick" to get out of something
10. On occasion, I have had doubts about my ability to succeed in life.

Appendix E

Statistical Models and Tables 14–26

Table 14. Descriptive Statistics and Correlations

	Variable	mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Group Size	3.89	0.65																				
2	Instructor2	0.09	0.29	0.01																			
3	Instructor3	0.29	0.46	-0.14	-0.21																		
4	Instructor4	0.19	0.39	-0.29	-0.16	-0.31																	
5	Instructor5	0.19	0.39	0.01	-0.16	-0.31	-0.23																
6	Instructor6	0.09	0.29	0.06	-0.10	-0.21	-0.16	-0.16															
7	Instructor7	0.07	0.25	0.28	-0.09	-0.17	-0.13	-0.13	-0.09														
8	Average GPA	2.94	0.28	0.19	-0.05	-0.03	0.09	0.02	-0.15	0.02													
9	Prior Sim Exp.	0.52	0.71	-0.16	-0.01	-0.12	-0.04	0.19	0.12	-0.02	-0.02												
10	Social Desirability	4.89	1.06	0.00	0.14	0.07	-0.17	-0.01	-0.09	0.04	-0.17	0.15											
11	Group Formation 2	.057	.23	-0.08	0.20	0.02	-0.12	-0.01	0.06	-0.07	-0.06	0.14	0.00										
12	Group Formation 3	.302	.46	-0.08	0.00	-0.02	0.05	0.05	0.00	-0.09	0.16	0.06	0.02	-0.16									
13	Group Formation 4	.433	.49	0.12	-0.02	-0.02	0.06	-0.03	-0.02	0.07	-0.21	-0.19	-0.10	-0.21	-0.58								
14	Group Formation 5	.160	.36	0.00	-0.05	0.06	-0.15	-0.01	-0.05	0.09	0.15	-0.03	0.12	-0.11	-0.29	-0.38							
15	Prior Social Int.	3.13	2.33	0.06	-0.15	0.06	0.03	0.02	0.20	-0.14	0.04	0.24	-0.08	0.19	0.16	-0.36	-0.21						
16	Prior Task Int.	2.55	1.98	0.08	-0.08	0.01	-0.05	0.08	0.21	-0.13	0.04	0.24	-0.08	0.27	0.14	-0.30	-0.28	0.89					
17	Round 1 BSG	65.62	20.0	0.07	0.06	-0.01	-0.06	0.09	0.07	0.00	0.08	0.18	-0.16	0.05	0.01	-0.19	0.22	0.01	0.01				
18	Round 1 Cohesion	44.73	5.4	0.00	0.05	0.00	-0.05	0.08	0.13	-0.15	0.06	0.25	0.22	0.10	0.25	-0.33	-0.08	0.38	0.31	0.15			
19	Round 2 BSG	64.53	22.5	0.09	0.03	-0.06	-0.09	0.05	0.10	0.06	0.11	0.21	-0.09	0.10	0.02	-0.18	0.12	0.12	0.10	0.65	0.24		
20	Round 2 Cohesion	44.87	5.3	-0.06	0.05	-0.09	0.09	0.00	0.13	-0.08	0.05	0.28	0.15	0.06	0.20	-0.35	0.03	0.37	0.29	0.23	0.84	0.37	
21	Round 3 BSG	60.42	24.2	0.05	0.01	-0.07	-0.03	0.01	0.06	0.17	0.05	0.27	0.00	0.07	0.10	-0.19	0.05	0.12	0.09	0.46	0.18	0.79	0.31
22	Round 3 Cohesion	45.34	4.7	-0.10	-0.05	-0.04	0.00	0.08	0.14	-0.10	-0.06	0.34	0.15	0.14	0.15	-0.26	-0.10	0.35	0.29	0.18	0.76	0.39	0.83
23	Round 4 BSG	54.77	27.4	0.07	-0.06	-0.09	0.05	-0.01	0.07	0.19	0.12	0.24	0.01	-0.02	0.20	-0.19	-0.01	0.14	0.08	0.30	0.25	0.67	0.36
24	Round 4 Cohesion	44.87	5.6	-0.08	-0.07	0.04	0.05	-0.01	0.08	-0.12	-0.05	0.33	0.16	0.11	0.20	-0.24	-0.14	0.40	0.28	0.09	0.77	0.28	0.78
25	Round 5 BSG	56.22	27.3	0.02	-0.03	-0.08	0.02	-0.06	0.14	0.17	0.03	0.23	0.02	0.06	0.16	-0.13	-0.09	0.17	0.11	0.23	0.28	0.62	0.39
26	Round 5 Cohesion	44.83	5.8	-0.09	-0.06	-0.02	0.06	-0.01	0.19	-0.12	-0.04	0.37	0.15	0.09	0.30	-0.27	-0.21	0.37	0.27	0.10	0.77	0.26	0.79
27	Round 6 BSG	56.38	28.1	0.05	-0.04	-0.09	0.03	-0.06	0.15	0.16	0.05	0.19	-0.02	-0.01	0.09	-0.06	-0.06	0.13	0.09	0.23	0.23	0.59	0.31
28	Round 6 Cohesion	44.41	6.2	-0.03	-0.12	-0.02	0.09	0.04	0.10	-0.08	-0.09	0.29	0.13	0.07	0.21	-0.24	-0.15	0.39	0.28	0.09	0.68	0.25	0.73
29	Round 7 BSG	54.43	29.1	0.04	-0.08	-0.08	-0.02	-0.04	0.21	0.16	0.06	0.17	0.02	-0.02	0.08	-0.06	-0.06	0.12	0.09	0.21	0.21	0.57	0.26
30	Round 7 Cohesion	45.12	6.6	-0.08	-0.13	0.07	0.08	-0.01	0.16	-0.18	-0.04	0.24	0.10	0.14	0.25	-0.30	-0.13	0.37	0.29	0.09	0.68	0.27	0.71

N=106. Significance levels are |.19| = p<.05; |.24| = p<.01. Values above or below the absolute values noted are significant at the levels noted.
Cronbach's alpha are reported on the diagonals for the cohesion scales.

Table 14. Descriptive Statistics and Correlations

	Variable	21	22	23	24	25	26	27	28	29
22	Round 3 Cohesion	0.34								
23	Round 4 BSG	0.88	0.39							
24	Round 4 Cohesion	0.32	0.84	0.39						
25	Round 5 BSG	0.81	0.41	0.92	0.41					
26	Round 5 Cohesion	0.28	0.84	0.36	0.92	0.41				
27	Round 6 BSG	0.75	0.34	0.85	0.35	0.93	0.35			
28	Round 6 Cohesion	0.29	0.81	0.36	0.86	0.39	0.89	0.35		
29	Round 7 BSG	0.74	0.30	0.79	0.28	0.85	0.30	0.92	0.35	
30	Round 7 Cohesion	0.26	0.75	0.33	0.78	0.35	0.80	0.34	0.85	0.39

Table 15. Dependent Variable — Post–Round 1 Cohesion

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	b	*b*	*b*	*b*	*b*	*b*
Intercept	21.01	30.68 ***	28.22 ***	30.14 ***	29.00 ***	29.09 ***
Group Size	1.09	1.20	0.82	1.14	0.81	0.54
Instructor2	3.31	2.99	3.19	3.04	3.11	2.25
Instructor3	3.13	2.94	2.31	2.88	2.02	1.29
Instructor4	3.22	2.80	2.37	2.80	1.91	1.20
Instructor5	3.42	3.23	2.89	3.17	2.88	2.17
Instructor6	4.90 †	4.40 †	3.64	4.28 †	3.58	2.82
Instructor7	-1.02	-0.36	-0.28	-0.32	-0.46	-0.90
Average GPA	3.83 *	2.19	1.86	2.13	1.87	1.28
Social Desirability	1.09 *	1.08 *	1.15 *	1.10 *	1.13 *	1.30 **
Group Formation 2		-3.36	-1.02	-3.02	-0.75	-0.85
Group Formation 3		-3.10	-0.04	-2.55	-0.29	-0.36
Group Formation 4		-6.84 **	-2.98	-6.16 †	-3.24	-3.08
Group Formation 5		-5.76 *	-1.90	-5.01	-2.54	-3.08
Prior Social Int			0.52	0.12	1.02 †	1.07
Prior Task Int				30.14 ***	-0.71	-0.74
Round 1 Perf						0.04
Adjusted R^2	7.8%	17.9%	19%	17.1%	19.4%	20.2%
ΔR^2	7.8%	10.1%	11%	9.3%	11.6%	0.9%

Note: † = p<.10; * = p<.05; ** = p<.01; *** = p<.001

Table 16. Dependent Variable — Post–Round 2 Cohesion

	Model 7	Model 8		Model 9		Model 10		Model 11		Model 12		Model 13	
	b	*b*		*b*		*b*		*b*		*b*		*b*	
Intercept	24.26	33.06	***	30.10	***	31.71	***	30.63	***	30.76	***	29.79	***
Group Size	0.41	0.62		0.16		0.46		0.16		-0.26		0.01	
Instructor2	1.86	2.19		2.43		2.31		2.38		1.06		2.31	
Instructor3	0.84	1.05		0.30		0.92		0.10		-1.02		0.22	
Instructor4	2.90	3.06		2.55		3.08		2.23		1.14		2.33	
Instructor5	0.84	1.09		0.68		0.95		0.67		-0.42		0.68	
Instructor6	3.12	3.13		2.22		2.84		2.18		1.01		1.91	
Instructor7	-0.49	0.26		0.36		0.38		0.24		-0.43		-0.11	
Average GPA	4.78	* 3.29	†	2.89		3.14	†	2.89		1.99		1.88	
Social Desirability	0.72	0.66		0.73		0.69		0.72		0.98	*	0.84	†
Group Formation 2		-4.25		-1.44		-3.40		-1.25		-1.41		-1.44	
Group Formation 3		-3.61		0.08		-2.23		-0.09		-0.20		-0.06	
Group Formation 4		-7.04	***	-2.39		-5.33	†	-2.56		-2.32		-2.13	
Group Formation 5		-4.37	†	0.28		-2.50		-0.15		-1.00		-0.06	
Prior Social Int				0.62	†	0.30		0.97	†	1.05		0.88	†
Prior Task Int						31.71	***	-0.48		-0.53		-0.40	
Round 1 Perf										0.06	*		
Round 2 Perf												0.06	***
Adjusted R^2	4.8%	14.5%		16%		14%		16%		20%		24%	
ΔR^2	4.8%	9.7%		12%		9%		11%		3%		8%	

Note: † = p<.10; * = p<.05; ** = p<.01; *** = p<.001

Table 17. Dependent Variable — Post–Round 3 Cohesion

	Model 14		Model 15		Model 16		Model 17		Model 18		Model 19		Model 20		Model 21	
	b		*b*		*b*		*b*		*b*		*b*		*b*		*b*	
Intercept	28.47		38.43	***	37.54	***	38.97	***	38.25	***	38.36	***	37.29	***	39.25	***
Group Size	-0.19		-0.20		-0.34		-0.14		-0.35		-0.71		-0.52		-0.52	
Instructor2	-0.87		-1.52		-1.45		-1.57		-1.52		-2.68		-1.60		-1.97	
Instructor3	-0.09		-0.52		-0.75		-0.46		-1.01		-2.00		-0.87		-1.32	
Instructor4	0.28		-0.44		-0.59		-0.44		-1.01		-1.97		-0.91		-1.39	
Instructor5	0.27		-0.10		-0.22		-0.04		-0.23		-1.20		-0.22		-0.49	
Instructor6	1.72		0.96		0.69		1.08		0.63		-0.40		0.33		0.18	
Instructor7	-1.65		-1.31		-1.28		-1.35		-1.44		-2.04		-1.84		-2.68	
Average GPA	5.00	***	3.51		3.39	*	3.57	*	3.40	*	2.60		2.25		2.17	
Social Desirability	0.58		0.63		0.65		0.61		0.64		0.87	*	0.77	*	0.70	†
Group Formation 2			-3.10		-2.24		-3.43		-2.00		-2.13		-2.20		-2.27	
Group Formation 3			-4.39	*	-3.27		-4.93	†	-3.49		-3.59		-3.46		-3.71	
Group Formation 4			-6.40	***	-4.99		-7.08	*	-5.23		-5.01		-4.74		-5.00	
Group Formation 5			-6.50	**	-5.09		-7.24	*	-5.67	†	-6.41	†	-5.57	†	-5.88	†
Prior Social Int					0.19				0.19	*	0.72		0.55		0.60	
Prior Task Int							0.73	*	0.22		-0.69		-0.55		-0.60	
Round 1 Perf											0.05					
Round 2 Perf													**0.00**	***		
Round 3 Perf															**0.00**	***
Adjusted R^2	6.9%		14.7%		14%		14%		15%		18%		28%		22%	
ΔR^2	6.9%		7.8%		7%		7%		8%		3%		13%		7%	

Note: † = p<.10; * = p<.05; ** = p<.01; *** = p<.001

Table 18. Dependent Variable — Post–Round 4 Cohesion

	Model 22	Model 23	Model 24	Model 25	Model 26	Model 27	Model 28	Model 29	Model 30
	b	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*
Intercept	20.84	31.08 ***	28.17 ***	31.19 ***	29.53 ***	29.62 ***	28.76 ***	30.61 ***	32.02 ***
Group Size	0.29	0.25	-0.20	0.26	-0.22	-0.50	-0.35	-0.40	-0.53
Instructor2	-1.57	-2.47	-2.24	-2.48	-2.38	-3.27	-2.44	-2.86	-2.76
Instructor3	0.58	-0.03	-0.77	-0.01	-1.28	-2.04	-1.17	-1.61	-1.69
Instructor4	0.98	-0.05	-0.55	-0.05	-1.37	-2.10	-1.28	-1.77	-2.18
Instructor5	-0.95	-1.55	-1.95	-1.54	-1.97	-2.72	-1.96	-2.25	-2.36
Instructor6	0.81	-0.18	-1.07	-0.15	-1.18	-1.97	-1.42	-1.66	-1.98
Instructor7	-2.77	-2.41	-2.31	-2.42	-2.63	-3.08	-2.95	-3.96	-4.42 †
Average GPA	6.61 ***	5.06 **	4.67 *	5.07 **	4.68 *	4.07 *	3.76 *	3.36	3.21 †
Social Desirability	0.72	0.78	0.85 †	0.77	0.83 †	1.00 *	0.93	0.90 †	0.86 †
Group Formation 2		-2.94	-0.17	-3.01	0.30	0.20	0.14	0.01	0.32
Group Formation 3		-3.59	0.03	-3.71	-0.39	-0.46	-0.36	-0.63	-0.98
Group Formation 4		-6.30 **	-1.71	-6.44 †	-2.16	-2.00	-1.77	-1.92	-1.86
Group Formation 5		-7.09 **	-2.51	-7.25 *	-3.62	-4.19	-3.54	-3.85	-3.65
Prior Social Int			0.61 †		1.49 **	1.55 **	1.41 **	1.44 **	1.33 **
Prior Task Int				-0.02 *	-1.24 *	-1.27 *	-1.16 *	-1.19 *	-1.04 †
Round 1 Perf						0.04			
Round 2 Perf							0.06 **		
Round 3 Perf								0.06 **	
Round 4 Perf									0.06 ***
Adjusted R^2	8.2%	16%	17%	15%	20%	21%	26%	26%	29%
ΔR^2	8.2%	7%	9%	6%	12%	1%	5.7%	5.9%	9.0%

Note: † = p<.10; * = p<.05; ** = p<.01; *** = p<.001

Table 19. Dependent Variable — Post–Round 5 Cohesion

	Model 31	Model 32	Model 33	Model 34	Model 35	Model 36	Model 37	Model 38	Model 39	Model 40
	b	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*
Intercept	18.44	27.94 ***	26.42 ***	29.17 ***	27.81 ***	27.90 ***	27.14 ***	28.63 ***	29.79 ***	28.83 ***
Group Size	0.21	0.15	-0.08	0.29	-0.10	-0.38	-0.22	-0.24	-0.35	-0.12
Instructor2	-0.57	-1.60	-1.48	-1.71	-1.62	-2.50	-1.67	-1.99	-1.92	-1.74
Instructor3	0.88	0.17	-0.22	0.29	-0.75	-1.49	-0.65	-0.99	-1.07	-0.75
Instructor4	1.95	0.68	0.42	0.66	-0.41	-1.14	-0.34	-0.72	-1.06	-0.64
Instructor5	-0.07	-0.86	-1.07	-0.74	-1.10	-1.83	-1.09	-1.31	-1.40	-0.99
Instructor6	3.59	2.49	2.02	2.75	1.91	1.13	1.70	1.55	1.28	1.21
Instructor7	-1.83	-1.40	-1.34	-1.50	-1.67	-2.12	-1.95	-2.68	-3.09	-3.07
Average GPA	7.15 ***	5.64 **	5.43 **	5.77	5.45 **	4.84 *	4.64 *	4.45 *	4.28 *	4.33 *
Social Desirability	0.76	0.82 †	0.85	0.79	0.83 †	1.00 *	0.92 *	0.89 †	0.85 †	0.81 †
Group Formation 2		-2.75	-1.30	-3.53	-0.81	-0.92	-0.96	-1.03	-0.79	-1.53
Group Formation 3		-1.83	0.07	-3.09	-0.37	-0.44	-0.34	-0.55	-0.83	-1.15
Group Formation 4		-5.67 *	-3.26	-7.23 *	-3.73	-3.56	-3.38	-3.54	-3.48	-4.05
Group Formation 5		-6.98 **	-4.58	-8.69 *	-5.72	-6.28 †	-5.65	-5.89	-5.74	-5.83
Prior Social Int			0.32		1.22 *	1.28 *	1.16 *	1.18 *	1.09 *	1.01 †
Prior Task Int				-0.28	-1.27 *	-1.30 *	-1.20 *	-1.23 *	-1.12 †	-1.08 †
Round 1 Perf						0.04				
Round 2 Perf							0.05 *			
Round 3 Perf								0.05 *		
Round 4 Perf									0.05 **	
Round 5 Perf										0.06 ***
Adjusted R^2	12.2%	23%	23%	23%	26%	27%	30%	29%	31%	33%
ΔR^2	12.2%	11%	11%	11%	14%	1%	4%	3%	5%	6%

Note: † = p<.10; * = p<.05; ** = p<.01; *** = p<.001

Table 20. Dependent Variable — Post–Round 6 Cohesion

	Model 41	Model 42	Model 43	Model 44	Model 45	Model 46	Model 47	Model 48	Model 49	Model 50	Model 51
	b	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*
Intercept	18.06	29.97 ***	27.81 **	30.70 ***	29.19 ***	29.28 ***	28.38 ***	30.23 ***	31.47 ***	30.35 ***	29.96 ***
Group Size	0.90	0.86	0.52	0.94	0.51	0.23	0.36	0.33	0.22	0.49	0.38
Instructor2	-1.36	-2.21	-2.04	-2.27	-2.18	-3.07	-2.24	-2.64	-2.52	-2.31	-2.38
Instructor3	1.46	0.85	0.29	0.92	-0.23	-0.98	-0.11	-0.54	-0.60	-0.24	-0.34
Instructor4	3.16	2.06	1.69	2.05	0.86	0.13	0.95	0.47	0.11	0.60	0.49
Instructor5	1.08	0.47	0.18	0.55	0.15	-0.59	0.16	-0.11	-0.20	0.27	0.18
Instructor6	2.72	1.70	1.03	1.85	0.92	0.13	0.66	0.45	0.19	0.12	-0.01
Instructor7	-1.18	-0.72	-0.65	-0.78	-0.97	-1.42	-1.31	-2.26	-2.60	-2.56	-2.35
Average GPA	6.04**	4.27 †	3.97 †	4.34 *	3.99 †	3.38	3.01	2.72	2.65	2.71	2.86
Social Desirability	0.77	0.82	0.88	0.81	0.85	1.03 †	0.97 †	0.92 †	0.88 †	0.83	0.89 †
Group Formation 2		-4.08	-2.02	-4.54	-1.53	-1.64	-1.71	-1.82	-1.51	-2.36	-1.53
Group Formation 3		-4.35	-1.65	-5.09	-2.08	-2.16	-2.05	-2.31	-2.61	-2.97	-2.54
Group Formation 4		-7.53 **	-4.12	-8.45 *	-4.58	-4.41	-4.16	-4.34	-4.30	-4.95	-4.77
Group Formation 5		-8.10 **	-4.68	-9.10 *	-5.81	-6.38	-5.73	-6.03	-5.84	-5.93	-5.85
Prior Social Int			0.46		1.35 *	1.41 *	1.27 *	1.30 *	1.20 *	1.10 †	1.21 *
Prior Task Int				-0.16	-1.26 †	-1.29 *	-1.18 †	-1.21 †	-1.08 †	-1.05 †	-1.15 †
Round 1 Perf						0.04					
Round 2 Perf							0.06**				
Round 3 Perf								0.06 *			
Round 4 Perf									0.06 **		
Round 5 Perf										0.07***	
Round 6 Perf											0.06 ***
Adjusted R^2	5.7%	14%	14%	13%	16%	17%	22%	21%	22%	24%	24%
ΔR^2	5.7%	8%	8%	7%	10.7%	0.5%	5.2%	4.3%	5.8%	7.5%	7.6%

Note: † = p<.10; * = p<.05; ** = p<.01; *** = p<.001

Table 21. Dependent Variable — Post–Round 7 Cohesion

	Model 52	Model 53	Model 54	Model 55	Model 56	Model 57	Model 58	Model 59	Model 60	Model 61	Model 62	Model 63
	b	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*
Intercept	21.84	31.94	30.32 ***	32.38 ***	31.30 ***	31.37 ***	30.42 ***	32.34 ***	33.75 ***	32.46 ***	32.16 ***	30.66 ***
Group Size	0.65	0.80	0.55	0.85	0.54	0.31	0.38	0.37	0.23	0.52	0.40	0.51
Instructor2	-1.23	-2.22	-2.08	-2.25	-2.19	-2.92	-2.25	-2.65	-2.56	-2.32	-2.40	-2.09
Instructor3	2.74	2.30	1.89	2.35	1.52	0.90	1.66	1.21	1.12	1.52	1.40	1.41
Instructor4	3.41	2.82	2.54	2.81	1.95	1.35	2.05	1.57	1.15	1.70	1.54	1.80
Instructor5	1.05	0.65	0.42	0.69	0.41	-0.21	0.42	0.14	0.03	0.53	0.44	0.35
Instructor6	4.63	3.80	3.31	3.90	3.23	2.58	2.95	2.76	2.44	2.43	2.20	1.60
Instructor7	-3.15	-2.46	-2.40	-2.49	-2.63	-3.01	-3.00	-3.91	-4.39	-4.22	-4.15	-4.46 †
Average GPA	5.23 *	3.26	3.04	3.31	3.05	2.55	2.00	1.78	1.61	1.78	1.80	1.98
Social Desirability	0.74	0.77	0.81	0.76	0.80	0.94	0.92	0.87	0.83	0.78	0.84	0.75
Group Formation 2		-0.69	0.85	-0.97	1.20	1.11	1.01	0.91	1.22	0.37	1.19	1.74
Group Formation 3		-2.33	-0.31	-2.78	-0.61	-0.67	-0.58	-0.84	-1.19	-1.50	-1.12	-0.55
Group Formation 4		-6.65 *	-4.10	-7.21 †	-4.43	-4.29	-3.98	-4.19	-4.12	-4.80	-4.64	-4.02
Group Formation 5		-6.25 *	-3.70	-6.86	-4.49	-4.96	-4.40	-4.71	-4.52	-4.61	-4.53 *	-3.83 *
Prior Social Int			0.34		0.97	1.02	0.88	0.92	0.81	0.73	0.81	0.84
Prior Task Int				-0.10	-0.89	-0.92	-0.80	-0.84	-0.70	-0.68	-0.77	-0.76
Round 1 Perf						0.03						
Round 2 Perf							0.06 **					
Round 3 Perf								0.06 *				
Round 4 Perf									0.06 **			
Round 5 Perf										0.07 ** *		
Round 6 Perf											0.07 ***	
Round 7 Perf												0.08 ***
Adjusted R^2	7.3%	17%	17%	16%	17%	17%	23%	21%	23%	24%	26%	29%
ΔR^2	7.3%	10%	9%	9%	10.0%	0.0%	5.4%	3.7%	6.0%	6.5%	8.3%	11.3%

Note: † = p<.10; * = p<.05; ** = p<.01; *** = p<.001

Table 22. Dependent Variable — Rounds 1 and 2 Performance

	Round 1	Round 2	
	Model 64	Model 65	Model 66
	b	*b*	*b*
Intercept	11.06	8.23	-30.49
Group Size	4.41	2.66	1.70
Instructor2	17.90 †	6.60	4.29
Instructor3	13.46	3.04	-0.05
Instructor4	10.00	-0.75	-2.96
Instructor5	13.78	3.24	-0.08
Instructor6	13.97	8.41	2.85
Instructor7	9.60	7.31	8.03
Prior Simulation Exp	1.31	3.05	1.97
Average GPA	14.48	18.01 *	15.41 †
Social Desirability	-3.67 †	-2.43	-3.76 †
Post–Round 1 Cohesion			1.08 *
Adjusted R^2	2.6%	0%	1.2%
ΔR^2	2.6%	0%	1.2%

Note: † = p<.10; * = p<.05; ** = p<.01; *** = p<.001

Table 23. Dependent Variable — Rounds 3 and 4 Performance

	Round 3			Round 4			
	Model 67	Model 68	Model 69	Model 70	Model 71	Model 72	Model 73
	b	*b*	*b*	*b*	*b*	*b*	*b*
Intercept	-20.25	-30.53	-51.91	-42.52	-51.77	-71.02	-102.25
Group Size	1.85	1.17	1.83	3.24	2.44	3.37	3.89
Instructor2	7.22	5.02	4.66	5.26	1.08	1.29	7.37
Instructor3	4.79	2.23	4.09	7.24	2.93	5.74	7.38
Instructor4	4.87	2.08	1.46	13.39	7.77	7.21	11.82
Instructor5	3.45	1.11	2.64	6.02	2.45	5.08	6.06
Instructor6	7.92	4.23	4.31	14.34	9.21	10.26	12.00
Instructor7	20.90 †	21.37 †	21.14 †	26.72 †	27.08 *	26.63 *	29.73 *
Prior Simulation Exp	1.62	1.09	0.78	4.41	3.72	3.56	4.95
Average GPA	24.08 **	21.33 *	18.77 *	24.16 *	19.80 †	16.88 †	14.02
Social Desirability	-0.82	-1.58	-1.92	0.39	-0.98	-1.11	-1.00
Post–Round 1 Cohesion		0.63			1.06 †		
Post–Round 2 Cohesion			1.28 **			1.66 ***	
Post–Round 3 Cohesion							2.19 ***
Adjusted R^2	2.1%	0.1%	5.4%	3.7%	6.0%	11.4%	14.8%
ΔR^2	2.1%	-1.9%	3.3%	3.7%	2.3%	7.7%	11.0%

Note: † = p<.10; * = p<.05; ** = p<.01; *** = p<.001

Table 24. Dependent Variable — Round 5 Performance

	Model 74	Model 75	Model 76	Model 77	Model 78
	b	*b*	*b*	*b*	*b*
Intercept	-21.34	-32.83	-50.33	-79.34	-62.98
Group Size	0.66	-0.55	0.48	0.98	0.12
Instructor2	4.51	-0.33	0.13	6.43	7.78
Instructor3	4.38	-0.74	2.39	3.99	3.42
Instructor4	8.59	2.46	1.94	6.70	6.51
Instructor5	0.70	-3.84	-0.82	0.19	2.94
Instructor6	17.08	10.19	11.64	13.55	16.34
Instructor7	23.98 †	24.82 †	24.28 †	27.42 *	29.40 *
Prior Simulation Exp	1.79	0.88	0.79	2.26	2.37
Average GPA	22.4 *	16.62	13.66	10.97	9.48
Social Desirability	0.33	-1.13	-1.17	-0.98	-1.12
Post–Round 1 Cohesion		1.21 *			
Post–Round 2 Cohesion			1.76 ***		
Post–Round 3 Cohesion				2.23 ***	
Post–Round 4 Cohesion					2.01 ***
Adjusted R^2	2.0%	5.6%	11.1%	13.7%	14.0%
ΔR^2	2.0%	3.6%	9.1%	11.7%	12.0%

Note: † = p<.10; * = p<.05; ** = p<.01; *** = p<.001

Table 25. Dependent Variable — Round 6 Performance

	Model 79	Model 80	Model 81	Model 82	Model 83	Model 84
	b	*b*	*b*	*b*	*b*	*b*
Intercept	-14.99	-39.85	-49.32	-79.70	-69.54	-60.83
Group Size	2.34	1.37	2.29	2.78	2.01	2.01
Instructor2	3.68	-0.16	0.63	6.18	7.73	5.76
Instructor3	4.44	0.50	3.40	4.93	4.55	3.39
Instructor4	9.33	5.25	4.96	9.17	9.19	7.16
Instructor5	1.28	-2.65	0.31	1.21	3.94	1.79
Instructor6	18.41	12.37	14.19	15.71	18.34	12.39
Instructor7	22.18	22.96	22.41	25.28 †	27.43 *	25.23 †
Prior Simulation Exp	2.09	1.08	1.16	2.40	2.53	1.91
Average GPA	19.24 †	15.15	12.90	10.13	8.18	7.99
Social Desirability	-0.47	-1.91	-1.74	-1.68	-1.90	-1.84
Post–Round 1 Cohesion		1.17 †				
Post–Round 2 Cohesion			1.48 **			
Post–Round 3 Cohesion				2.02 ***		
Post–Round 4 Cohesion					1.96 ***	
Post–Round 5 Cohesion						1.75 ***
Adjusted R^2	0.1%	0.9%	3.6%	6.7%	8.5%	6.5%
ΔR^2	0.1%	0.8%	3.5%	6.6%	8.4%	6.4%

Note: † = p<.10; * = p<.05; ** = p<.01; *** = p<.001

Table 26. Dependent Variable — Round 7 Performance

	Model 85	Model 86	Model 87	Model 88	Model 89	Model 90	Model 91
	b	*b*	*b*	*b*	*b*	*b*	*b*
Intercept	-3.10	-12.68	-21.32	-48.05	-33.23	-28.04	-36.15
Group Size	0.04	-0.70	0.04	0.46	-0.20	-0.19	-1.41
Instructor2	-0.01	-3.81	-3.24	1.36	2.24	0.82	2.54
Instructor3	3.88	0.39	2.71	4.02	3.51	2.66	2.38
Instructor4	5.42	1.16	0.90	4.41	4.17	2.66	0.76
Instructor5	2.66	-0.66	1.69	2.43	4.42	2.84	1.49
Instructor6	25.23 †	20.42	21.79	23.00	25.09 †	20.52	22.56
Instructor7	24.35	24.96 †	24.52 †	26.94 †	28.28 †	26.70 †	26.32 †
Prior Simulation Exp	3.92	3.22	3.26	4.28	4.36	3.89	5.33
Average GPA	14.94	10.93	9.05	6.62	5.78	5.44	5.70
Social Desirability	0.96	-0.18	-0.08	-0.06	-0.11	-0.10	-0.27
Post–Round 1 Cohesion		0.93					
Post–Round 2 Cohesion			1.21				
Post–Round 3 Cohesion				1.70 **			
Post–Round 4 Cohesion					1.47 *		
Post–Round 5 Cohesion						1.35 *	
Post–Round 6 Cohesion							1.68 ***
Adjusted R^2	1.6%	1.0%	2.9%	5.2%	4.8%	4.1%	9.0%
ΔR^2	1.6%	-0.5%	1.3%	3.6%	3.2%	2.5%	7.4%

Note: † = p<.10; * = p<.05; ** = p<.01; *** = p<.001