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SOCIAL NETWORKS IN ONLINE LEARNING ENVIRONMENTS

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ABSTRACT

SOCIAL NETWORKS IN ONLINE LEARNING ENVIRONMENT

By

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This study addresses issues central to the improvement and design of online learning environments by furthering the research on one of the main issues in online courses, that is, social interactions. Social interaction in online courses is desirable but problematic. It is significant to learning outcomes according to social learning theories, and highly correlated with students' sense of connectedness and satisfaction with the class. However, the high attrition rates in distance education point toward social interactions or more specifically the lack of social interactions being the cause.

A review of the literature on social interactions in online courses reveals a lack of understanding on how social interactions affect people's attitudes toward their learning, their sense of connectedness with the class, and the factors that might lead to social interactions. Literature in this area has produced several concepts that are useful in our understanding of social interactions but has not documented how these concepts are related to each other. These concepts, including social presence, social integration, computer-mediated communication/collaboration, and social ties, remain separate concepts in different research studies. Using a model that ties them together, this study fills some of the gaps that exist in the literature.

This dissertation furthers the understanding of online social interactions through using social network analysis, the study of how social ties develop, and how the ties affect the individuals. This approach provides insight into the relationships between

social interactions, participants' sense of connectedness in a class (social integration), social presence, and computer mediated communication technologies. Specifically, this study proposes a model to predict social integration using social interactions, social presence, and other factors. In addition, by studying social networks in online courses, this study attempts to uncover some of the factors that affect people's choice of online ties.

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CHAPTER ONE: RESEARCH PROBLEM AND SIGNIFICANCE OF THE STUDY

Research Problem

This dissertation examines social interactions in online learning. More specifically it investigates two important issues concerning the social aspect of online learning: (a) the context and extent to which social interactions in online courses affect students' sense of social connectedness to the course or program; and (b), how students in online courses decide to interact with each other or what factors affect their decision on their social ties in online learning. These two issues are significant because they are fundamental to a fuller understanding of the social aspects of online education, which has been a growing concern for researchers and educators recently as online education continues to expand at a rapid speed.

Significance of the Problem

The rapid growth of online courses has been associated its obvious advantages associated with learning "anytime, anywhere" (Swan et al., 2000). Yet the lack of face-to-face interactions has caused concerns among educators and researchers (Bullen, 1998; Sherry, 1996). Students in online courses have been found to experience a sense of disconnectedness with the rest of the class (Hughes & Hewson, 1998; Ward & Newlands, 1998), which ultimately affects their learning and satisfaction with online courses (Gunawardena, 1995).

Another area of concern related to a lack of interactions in distance education, is the persistent problem of high drop-out rates compared to that of traditional courses

(Narasimharao, 1999; Rumble, 1992; Schlosser & Anderson, 1994; Shin & Kim, 1999). Carr (2000) reported in an article in the Chronicle of Higher Education that "no national statistics exist yet about how many students complete distance programs or courses, but anecdotal evidence and studies by individual institutions suggest that course-completion and program-retention rates are generally lower in distance-education courses than in their face-to-face counterparts."

Critics of distance education literature, which suggests that there is no difference in terms of learning outcomes between distance and traditional education, observe the fact that distance education learning outcomes include outcomes of those who completed the program without considering those who dropped out (Zhao et al., in press). This dropout problem in distance education has been a widely acknowledged phenomenon and has attracted much attention from distance education administrators and researchers (Narasimharao, 1999; Rumble, 1992, Schlosser & Anderson, 1994).

The significance of social interaction in learning has long been affirmed in traditional learning settings through theoretical and empirical studies. According to Brown and Duguid (2000), "social groups provide resources for their members to learn" and "learning is remarkably social" (p. 139). These social groups form learning communities that have shared goals, and members of these learning communities share and propagate knowledge. In addition, the level of students' social interactions with the campus learning community or *social integration* has been identified as a main factor of student retention in student attrition theories (Tinto, 1975). The lack of social integration, or continuous participation, engagement, and connectedness would undermine instructional effectiveness, leading to increased student attrition (Yalama & Aydin,

2004). Empirical research affirms student attrition theories in showing that social interactions play a major role in students' sense of connectedness, which affects whether they stay in school (Bank, Biddle, & Slavings, 1990; Milem & Berger 1997; Pascarella, 1980; Tinto, 1975; Zhao et al., in press). Social learning theories, student attrition theories, and empirical studies have expounded upon or shown that social interaction is a key to academic success in traditional learning settings.

Social interaction in online learning settings is equally, if not more, important than in traditional settings, although it may take different forms and employ different media. Online and distance education literature has often cited social interaction as a major factor affecting the quality of experiences in online and distance learning (Kumari, 2001; Picciano, 2001; Sherry, 1996). After an extensive study of characteristics of effective internet-based distance education programs, Phipps and Merisotis (2000) concluded: "It has become increasingly evident that interactivity is the sine qua non for quality in distance education" (p. 16). It is thus no surprise that the facilitation of social interaction has been an important consideration in the improvement of online courses (Hallett & Cummings, 1997; Heath, 1998; Milheim, 1995; Palloff & Pratt, 1999).

In addition, empirical research shows that online social interaction has benefits that outweigh its complexity (Swan, 2001; Wang, Newlin, & Tucker, 2001). In a review of research, Zirkin and Sumler (1995) found that interaction seemed to have an impact on student achievement, as well as satisfaction: "The weight of evidence from the research reviewed was that increased student involvement by immediate interaction resulted in increased learning as reflected by test performance, grades, and student satisfaction" (p. 101). However, the problem of fostering social interactions in online courses is highly

complex because online communications and collaborations are mediated by technology (Hallet & Cummings, 1997; Heath, 1998).

Given the critical role of social interaction in learning outcomes, student satisfaction, and attrition, a better understanding of social interactions in online courses would be significant for understanding and ultimately improving online education. This study explored two sides of social interactions in online courses. Firstly, this study looked at the role of social interactions in affecting students' perception of their connectedness with the rest of the class, namely social integration. Secondly, since social interactions, in turn, are shaped in part by differences among individuals, the study also explored the relationship between student characteristics and social interactions. In other words, the study explored how social interactions in online learning environments affect students' perception of their social integration, and what student characteristics affect their choice of social interactions.

Outline of Remaining Chapters

The remainder of this dissertation is divided into five chapters. Chapter Two reviews relevant literature and points out gaps in past research. Chapter Three further discusses how these gaps translate into the theoretical framework of the study through the use of two models. Chapter Four describes the methodology of the study and the formulation of the design and implementation of the study. Chapter Five reports the findings of the study. Chapter Six discusses the implications of the findings in relation to online education, the limitation of the study, and suggests directions for future research.

CHAPTER TWO: SOCIAL INTERACTIONS IN EDUCATION: REVIEW OF THE LITERATURE

The impetus for this dissertation was the need to understand social interactions in online education so as to provide suggestions for improving the quality of online education. To achieve such an understanding, it is necessary to develop a theoretical framework that is, on the one hand, consistent with current knowledge of social interaction in education, derived primarily from examinations of traditional educational settings. On the other hand, the framework should take into consideration the unique nature of online education, which is characteristically different from traditional education in terms of how social interactions occur. Developing a framework that meets these criteria thus required examining relevant literature concerning both social interactions in traditional face-to-face education and online education.

This chapter begins with a brief overview of various definitions of social interactions and summary of research on social interactions and student learning outcomes, followed by an examination of how social interactions affect student retention. Then it looks at research on social interactions in online courses, and finally it uncovers some gaps in research, which will be addressed by this study.

Definitions of Social Interaction

The term *social interaction* has had varied meanings in educational literature. There are basically two different ways of conceiving of social interactions – one that has been used by social learning theories, and the other that is used by socio-psychological theories.

Social learning theories have focused on social interaction as interaction related to the cognitive development of the learners, rather than interaction related to socio-emotional processes. Brown, Collins, and Duguid (1989) elaborated on the use of social interactions in learning without giving it a formal definition, but used it consistently in conjunction with the construction of knowledge, or with apprenticeship learning. Social learning theories typically use social interactions to refer to any communications or conversations that promote the accomplishment of the learning tasks or the development of the cognitive understanding of the content. Examples of such interactions include participation in learning activities, group projects, and class discussions with other students and/or the instructor. From this perspective, social interactions do not include informal off-task communications, such as outside class friendships if they do not involve the construction of knowledge.

Social psychology takes social interaction to refer to any inter-personal communication regardless of whether its goal is related to cognitive or emotional processes. In an article identifying the pitfalls for social interaction in computer-supported collaborative learning environments, Kreijns (2003) stated that social interaction should not be restricted to cognitive processes. Students need to first have trusting or sympathetic relationships before they can benefit from collaborative learning (Rourke, 2000; Wegerif, 1998).

For the purposes of this study, the term social interaction is used in the broader sense to refer to any inter-personal communications. Therefore, the review of literature on social interactions and learning in this chapter encompasses the various aspects of

social interactions that relate to the cognitive processes, the socio-emotional processes, both in and out of class, with peers and with instructors.

Social Interactions and Student Learning

The basis for this study is the perspective that learning is a social process. According to the situative perspective, social interaction is a critical component of learning (Berge, 1996; Brooks & Brooks, 1999; Brown et al., 1989; Lave & Wenger, 1991) because knowledge is socially constructed. Advocates of this perspective propose that learning takes place in a community, where the learner gets help and support, and participates in collaborative learning (Lave & Wenger, 1991), which requires social interactions. The theme of this perspective is that "learning is being more effectively and centrally involved in the practices of the communities" (Greeno, Pearson, & Schoenfeld, 1997, p. 159), including basic aspects of participation, identity and membership in communities.

The premise for the importance of participation is the assumption that knowledge is "distributed among people and their environments, including the objects, artifacts, tools, books, and the communities of which they are a part" (Greeno & Collins, 1996). Since knowledge is distributed, it is necessary for learners to actively participate in the contribution and exchange of resources and knowledge in order for learning to take place. In short, social interactions is the central to learning in this perspective because learning occurs when members of the community or learners rely on social interactions to gain access to other members and participate in this community.

This line of reasoning stresses the impact of the social element in learning, where learning is not an isolated activity, but the accomplishment of the team. Students who are

stronger in some areas will help those who are weaker and vice versa. They work together to achieve success in the course (Riel & Fulton, 2001). As members depend on each other for learning, social interaction could be analogous to the glue that helps establish social ties and form relationships, without which knowledge could not be shared and distributed.

Social Interactions and Student Retention

In addition to improving student learning, social interaction is also important in keeping learners in a learning program. According to Tinto (1975), "social interaction via friendship support is directly related to persistence in college" (p. 107). As articulated in the models of student attrition from college, social interaction is central to achieving "social integration", a main factor in student retention in school (Scott, 2000; Spady, 1971; Tinto, 1993). Social integration refers to the degree to which people feel they have established social connections with others in their learning environment (Tinto 1993). Students who feel they are more socially integrated tend to be more successful than those who are not.

The a strong connection between students' sense of social interaction with peers and instructors and their dropout rate is accounted by the quality and quantity of such interactions affect their sense of how socially integrated they are with others (Robert & Thompson, 1994; Spady, 1971; Spitzer, 2001; Tinto, 1993). In other words, social interactions lead to friendships and social ties, which in turn can affect one's shared group values, socio-emotional support structure and enhance a sense of commitment to the institution (Scott, 2000). For example, Tinto and Russo (1994) found that "learning

communities," which attempt to develop linkages among teachers and students, have positive effects on social integration in community college.

Empirical studies found moderately strong correlations between social integration measures and several academic outcomes, including institutional commitment, retention, and career success (Thomas, 2000; William, 1998; Ashar & Skenes, 1993). For example, in a longitudinal analysis of 718 college students, Berger (1997) found students' sense of community in their residence halls to be a source of social integration and negatively related to student departure decisions. Furthermore, Pike, Schroeder and Berry (1997) found that, directly or indirectly, social integration and learning communities at the college level affect students' academic achievement and persistence. Vann and Hinton (1994) found that a high percent of dropouts were socially isolated whereas those that successfully completed their class were part of different cliques in class.

The idea of social integration is heavily grounded in the sociological perspective, as opposed to the psychological perspective on academic success of the learner. The psychological perspective views learner's success as a function of inherent personality traits, skills, perspective, or an individual psychological phenomenon, such as having an internal locus of control, and self-efficacy (Wang & Newlin, 2002), and "assertive, independent, self-disciplined, and motivated" (Cyrs, 1997). As an example of a typical psychological perspective, Eastmond (1995) noted that successful computer mediated communication (CMC) users are usually self-directed, self-motivated, technically proficient, and sociable. This implies that if learners do not possess these qualities, they are considered unfit for online learning. In this case, unless the instructor takes on the

responsibility to train their students to obtain these qualities, the students without these qualities will be unsuccessful.

Alternatively, the sociological perspective postulates that students' success in online learning may be affected by the qualities of learning environment as a whole, rather than qualities of individual students. Therefore, the sociological perspective may offer instructors and instructional designers more control by examining the properties of a successful learning environment. The sociological perspective assumes that every environment has a set of unique characteristics or qualities that is correlated with a propensity for student dropout.

This perspective originated from Durkheim's research on suicide. Durkheim (1997) defines suicide as applying to all "cases of death resulting directly or indirectly from a positive or negative act of the victim himself, which he knows will produce this result" (p. 110). His research showed that each society has a "rate of mortality through suicide", meaning that it has a natural proclivity for a certain percentage of suicide. This rate, according to Durkheim, was both permanent and variable in that it is relatively stable for individual societies, but at the same time, it is peculiar to, and characteristic of that society. In other words, each society is predisposed to contribute to a fixed number of suicides.

Durkheim argues that this rate of suicide cannot be explained by "organic-psychic constitution" of individuals, nor the nature of the environment, but by viewing it as a collective, social phenomenon. To support his claim, Durkheim studied the causes of suicide in "states of the various social environments" that varied in religious confessions, familial and political society, etc. He found that societies that are predominantly

Protestant have the highest suicide rate, followed by Catholic, and then Jewish. He reasoned that a possible difference between the Protestants and the Catholics is that Protestants are allowed more "free inquiry" than are Catholics. The result of this "free inquiry" is such that Protestants are not as uniform in their beliefs, and less integrated, compared to Catholics.

In addition to religious groups, Durkheim also examined political structures, and found that the rate of suicide increases as the society matures and disintegrates. He explains that the low rate of suicide during great social disturbances such as wars is due to the increased collective sentiments and patriotism, which implies a more integrated society. Durkheim refers to this suicide through a lack of social integration as "egoistic suicide."

Using the same analogy, the success or progress of a student in a learning environment also depends on social integration (Tinto, 1975). Following Durkheim, each learning environment has a natural propensity to have a certain dropout rate, depending on the social integration of each learning environment. The dropout rate is parallel to suicide cases in that the less integrative learning environments probably have higher dropout rates, and vice versa. The dropout phenomenon can now be seen in a different light: it is a collective and social phenomenon rather than an individual psychological phenomenon. There may even be a compromise of the two & they may be able to collaborate & enhance each other or help explain gaps in the other perspective. This not only helps justify the study of social interaction in learning environments, but also provides us with a model for looking at successful versus unsuccessful students.

In essence, every social environment has a propensity for success and failure. The larger social community in which we live has characteristics unique to itself, which will determine the suicide rate. The campus community has characteristics unique and peculiar to itself, which will determine student attrition. Similarly, this dissertation generalizes this assertion to individual online courses, which are assumed to also have unique attributes that will determine the student attrition rate.

To summarize, since social interactions is the vehicle for social integration, the idea central to being a part of a community, and consequently academic success, it is worth investigating the nature of social interactions in online courses, particularly in relation to students' social integration. This sociological perspective may help shed light on the persistent problem of attrition in distance online education (Cerny & Heines, 2001; Wang, & Newlin, 2002).

Nature and Development of Social Interactions in Traditional Classrooms

Literature on social interactions in traditional classrooms or campuses has found that there are particular interaction patterns, basically related to social and physical attributes. Empirical research that examined the effects of social and physical attributes on social ties is limited and has been done mostly in the traditional learning environment. The limited available studies suggest that social networks in the traditional classroom are very closely tied to social and physical attributes of the individuals, such as social-economic status, gender, and race (Stevenson, Davidson, Mane, & Walsh, 1997) as well as the sense of "being alike."

A study of social networks in a university, undergraduate students were found to prefer to pass small folders among their own class and did not pass folders to lower

classes (Stevenson et al., 1997). Females tend to pass folders to other women, and men tend to pass folders to other men. In the same study, graduate students, faculty and staff were found to be more closely connected to the administration as compared to undergraduate students, and freshmen were particularly isolated in communication networks.

Social Interactions and Online Learning

In proposing the importance of social interactions, this dissertation has looked at past research on social interactions, and student learning and even student retention, but has not yet addressed how the online learning environment makes a difference to social interactions. This section looks at issues concerning social interactions in online learning environments.

Social interactions in online learning environments take the form of emails, chats, video conferences, to name a few. These are also called computer mediated communications (CMC), since the interactions are mediated by technology. The characteristics of CMC technologies "shape the instructional and communication activities they support" (Romiszowski & Mason, 2001). Although some researchers have argued that technology is a tool (Levy, 1997; Means, 1994), technology is, in reality, neither passive nor neutral. It comes with different affordances, which to some degree determines what people can do with it. Cherny (1999) points out that "discourse patterns are related to the technical affordances of a system as well as the contexts of use" (p. 150). Cherny suggests that in order to study the interactivity of a system, it is necessary to first account for the different features present in the interface and infrastructure of the computerized environment in question. Different types of CMC technologies have

characteristics that affect people's behavior in the online environment (Romiszowski & Mason, 2001, Zhao et al. 2004).

Social interactions may be even more important in online learning than in face-to-face learning. Due to the lack of face-to-face interactions in on-line learning situations, the development of learning communities is of special significance, as argued by Harasim, Hiltz, Teles, and Turoff (1996):

> Social communication is an essential component of educational activity. Just as a face-to-face school or campus provides places for students to congregate socially, an online educational environment should provide a space, such as a virtual café, for informal discourse...The forging of social bonds has important socioaffective and cognitive benefits for the learning activities. The virtual café should be primarily a student space and not be directly tied to the curriculum. (p. 137)

Previous studies on social interactions and online learning can basically be categorized into two broad sections: (1) the relationship between social interactions and student learning outcomes, such as achievement and satisfaction (2), how social interactions happen in online courses. Following this categorization, this section is further sub-divided into (1) literature on social interactions and student learning outcomes (2), literature on the nature of social interactions in online courses.

Social Interactions and Student Learning Outcomes

There has been some, albeit limited, empirical research on how social interactions play out in individual online courses. In a metaanalysis of the role of social interaction in online courses, Lou, Abrami, and d'Apollonia (2001) concluded that social interaction

benefits learners by improving their learning strategies, improving their retention, and reducing the need for help from their instructor. In another study, researchers surveyed 3,800 students enrolled in 264 online courses, concluding that increased social interaction increased students' perception of their learning, and satisfaction (Shea, Fredericksen, Pickett, Pelz, & Swan, 2001). Likewise, Dziuban and Moskal (2001) has also conducted a large-scale study (N=52,218) over a three-year period and concluded that even though there are positive and statistically significant correlations between social interactions and satisfaction in both distance and traditional courses, social interactions seems to be a more critical factor relating to student satisfaction in distance courses. Cronje (1999) found that successful on-line group discussions are correlated with positive social relationships. In a study of 3800 students in 264 online courses, Swan (2001) found that social interactions with other students is significantly correlated with course satisfaction and perceived learning.

Another line of research on social presence - how present and immediate others seem in the learning environment – suggests that social interactions positively affect students; satisfaction. Social presence, a social-psychological concept, is defined as the "degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships..." (Short, Williams, & Christie, 1976, p. 65). As early as 1976, researchers postulated the importance of social presence as a critical factor in communication (Short et al., 1976). Later evidence points toward social presence as a significant factor of favorable learner outcomes (Hackman & Walker, 1990; Gunawardena & Zittle, 1997).

The perceived low level of social presence in distance and online education has been reported to have negative effects on student learning. The distance education literature clearly suggests that although students of distance education programs may learn as much if not more than their on-campus counterparts, they feel an overwhelming lack of social interaction with their peers and instructors, which results in a dissatisfaction with their learning experience (Gunawardena & Zittle, 1997). However, in a study on social presence and performance, Picciano (2002) found a small inverse but not statistically significant relationship.

The Nature and Development of Social Interactions in Online Courses

Past research on how social interactions happen in online courses has focused on the use of computer mediated communication (CMC), and on interaction patterns. Due to the different ways of enabling social interactions in face-to-face and online learning environments, how people form relationships and work together in the online environment and face-to-face environments also differ (Cherny 1999; Muffo & Connor, 1987; Romiszowski & Mason, 2001). For example, in face-to-face classroom environments, instructors can physically group students and have personal control over how they may work together, while in online situations instructors must use other technology mediated means to do so. In face-to-face learning settings, the physical configuration of the space can be used to shape social interactions among students and between the student and instructor while in online environments such physical configuration mechanisms as seating arrangement and physical distance are not available. In essence, all social interactions in online environments are mediated by technology and thus become more conceptual and psychological than physical.

However, a low level of social presence is not necessarily all negative. In fact, research shows that people respond to the low-social presence in the online environment with more aggression and honesty, much like literature on anonymity (Gunawardena, 1998). Research comparing the effects of anonymity of CMC on group dynamics with face-to-face group interaction suggests many benefits of using CMC in building online communities, even though interaction through CMC has lower social presence, thus higher anonymity, than face-to-face interaction. One of the benefits of using CMC is that it produces interaction that is more democratic and group oriented than face-to-face communication. Siegel et al. (1986) found that CMC groups interacted more and took longer in the decision-making process than similar groups in face-to-face discussion. Moreover, compared with groups in face-to-face settings, groups using CMC as the communication medium tend to treat each other more equally and have more equal levels of participation.

Another area of literature on social interactions in online courses relate to the development of social interactions. In this area, researchers have concluded that developing social interactions is a complex process, though it is achievable and desirable. Hallett and Cummings (1997) studied online postings in a small computer-mediated undergraduate course in educational psychology and observed that "[interaction] was not what took place" (p. 105). The study revealed the complexity of encouraging online social interaction. Heath (1998) also found it difficult to sustain consistent and thoughtful online participations over the course of a semester. Likewise, Muirhead (2001) concluded in a study of online participation that it declines over the semester.

Much of the literature on the development of social interactions in online courses has centered on how social interactions in online courses might be categorized or coded. Gunawardena, Lowe, and Anderson (1998) came up with a coding scheme for online interaction with five phases of knowledge construction. Salmon (2000) developed five stages of student participation in online classes.

A few studies of the development of social interactions in online courses have used social network analysis. Haythornthwaite (1998) used a social network approach to study growth of community and use of internet resources among a class of 15 distance learners enrolled in the LEEP option of the Master of Science in Library and Information Science at the University of Illinois at Urbana-Champaign. Class members reported on their interactions with others in the class at three points in the 15-week semester. From these reports, final interviews, and course evaluation questionnaires, Haythornthwaite found that group interaction patterns became less flexible over time, and that network positions, especially that of centrality which refers to the central positions of each social group, solidified during the middle of the term. The latter conclusion might have to do with the fact that the class met in the middle of the semester.

In addition, Haythornthwaite (1998) analyzed the networks in four different ways, including the networks which focused on *collaborative work*, *exchanging advice*, *socializing*, and *emotional support*. In these networks, she found that being central or peripheral in a collaborative work network also means being central or peripheral in an exchanging advice or socializing network, but not in an emotional support network. Accordingly, she also concluded that

actors' centrality is more strongly related to their individual sense of belonging to the class than to their impression of class activity and this sense of belonging seems to be related to the degree to which they actively exchange advice with others (Haythornthwaite, 1998, p. __).

In a later study, Haythornthwaite (2001a) found from a study of distance learners (N=27) that the stronger the tie, the more frequent the interaction, and the more variety in types of media used in the interactions. Stronger ties are characterized by higher levels of intimacy, social support, and self-disclosure. She suggested that the more media used by high frequency communicators may result from a greater need or desire to communicate leading pairs to seek out and use a variety of means of communication to accommodate their communication schedules and their work or social tasks (Haythornthwaite, 2001b; Haythornthwaite & Wellman 1998). Individuals with weaker ties, who depend on few (and often only one) media to communicate, tend to use the group-mandated means of communication to maintain their ties.

Gaps in Research

Past research has established a positive correlation between social interactions and student learning outcomes, developed different ways of coding online interaction, and expounded on the impact of online technologies on social interactions, but there are still gaps. This section will point out these gaps, which will be further developed into the theoretical framework in the next chapter.

First, past research has assumed a straightforward relationship between social integration and student social interactions – the frequency of social interactions causes students to feel more socially integrated – without considering the cumulative effects of social interactions. The result of interacting with three people who are all positive about

the course may be different than interacting with three people who are all negative about the course. Literature on this subject does not distinguish between having classmates and friends who are thinking of dropping out versus having classmates and friends who are successful learners. Social psychology suggests that when people interact, the participants actually get "influenced" in the process. Applying this perspective to students' sense of social integration, it is the frequency of interaction with others as well as the attitudes of the people you interact with that cause you to feel socially integrated. In other words, past literature does not account for the cumulative effect of interacting with people with different attitudes.

Second, there is a lack of research on the formation of online interactions. Instructors struggle to increase online interactions through imposing group structure, and research suggests that this is a complex issue, but research has not documented how online interactions develop. Some studies concluded that certain personal traits may be the reason for face-to-face interactions to develop, but nothing has been done in this area for online courses. Traditional studies found strong correlations between personal characteristics such as SES, gender, and race, on people's choice of interaction partners. Some researchers have hypothesized that these do not carry over on online environments, but literature on CMC suggests that online interaction may be more honest than that of traditional face-to-face interaction. This difference has not been examined. Haythornwaite's study (1998) using the social network approach found out that interaction patterns became less flexible over time, but did not get at the factors that motivated individuals to interact with particular people in their classes. One step toward understanding how online interactions develop is knowing whether student characteristics

affect their choice of online interaction partners. We know that certain traits are significant in forming relationships in traditional classrooms. However, the same traits may not apply to online interactions because these interactions are mediated by technology. Understanding the development of social interactions will take us a step closer to understanding how to manage these interactions for the purpose of learning.

CHAPTER THREE: DEVELOPMENT OF THE INFLUENCE AND SELECTION MODELS

The previous chapter identified several major gaps in past research that this study will address. This chapter addresses these gaps using the social network approach by developing two social network models for this study: the influence model and its components, followed by the selection model.

Social Network Analysis as a Theoretical Framework

The gaps derived from the literature review in the previous chapter relate to the effect of the learning environment in terms of social interactions, which can be understood by exploring the social ties or social networks in a learning environment. Social network analysis has been suggested as an effective way to achieve such understanding (Barnes, 1972, p.3.) and used as a way to study how the exchange of resources between individuals creates connectivity among all members of a social system (Berkowitz, 1982; Wellman, 1988; Wasserman & Faust, 1994).

Before embarking on how social networks addresses these two gaps, it is useful to have a brief understanding of social network analysis. Social network analysis is a way of understanding how resources are exchanged in a community through the mapping of

relationships (Wellman, 2000). It can be analyzed in terms of *nodes* and *ties*. Nodes represent the individual actors. An example of a tie would be two people who talk to each other. Each person would be represented by a node. The tie represents a connection between the two. However, this connection may be characterized by one or more *relations*. These relations among individuals refer to the resource that is exchanged. It can be directed, such as giving and receiving information, or undirected, such as maintaining a friendship. Relations also differ in strength, and include the exchange of complex information, emotional support, uncertain or equivocal communication, communication to generate ideas, create consensus, support work, foster sociable relations, or support virtual community (Garton & Haythornthwaite, 1997). Consider a situation where an individual X asked another individual Y for help with a class project. Y provides this help but otherwise they do not interact with each other. In this example, individual X is tied to individual Y in a one-time relationship. This relationship is characterized by content (the help being given), direction (the help going from individual Y to individual X), and strength (a weak tie due to the frequency of interaction).

In examining social networks, researchers have focused on two different processes which define how the networks develop. One of the two major forces that govern the social network structure in a system is *influence* (Frank & Fahrbach, 1999). Influence refers to a person's attitudes, beliefs, and subsequently, behavior being changed as a result of being connected to another person, supported by social psychology theories that suggest that people in a system need to conform to the norms within that system.

As mentioned earlier, a gap addressed by this study is the cumulative effect of interacting with others on participants' sense of connectedness or their sense of social

integration. From the social networks perspective, any change as a result of the cumulative effects of interaction with others is called *influence*. When the effect of influence is used to predict a certain outcome (in this case the outcome is participants' sense of connectedness with the class), this model is called the *influence model*. The influence model is used in social network analysis to predict an individual participant's attitudes and beliefs based on the cumulative effect of his/her interactions with others, with the assumption that interaction inevitably changes or influences the participant's attitudes and beliefs. The influence model is like a blank slate that can be used to predict various entities—from a person's attitude toward learning to a person's anxiety levels—hence the name influence model rather than social integration model.

Using a social networks Influence Model as a framework can help us understand the impact of the learning environment on students' social integration, as we are also considering the possibility that a person's attitudes and beliefs become changed as a result of the interaction. That is, we are incorporating the possibility that other people's perception of their social integration may change a student's perception of social integration. For example, if person A talks to person B and C, then person A's beliefs about his/her social integration may be affected by person B and C's perceptions about their social integration. Using a model of influence, it is possible to approximate and quantify the development of relationships and ties in online learning environments, and figure out how these relationships and ties affect a person's perception of social integration.

The other major force governing the social network structure in a system is *selection* (Frank & Fahrbach, 1999), the process through which actors choose to interact

with others based on their attributes (Wasserman & Faust, 1994). The *selection model*, briefly, defines "who interacts with whom." Through this process of selection, "actors generate their contexts by seeking out others with whom they interact" (Frank & Fahrbach, 1999, p. 262). The selection process has been described by socio-psychological theories such as the balance seeking theory, in which people seek to interact with others like themselves (Blau, 1977). For instance, a person may seek to interact with another person who seems have common interests. Other theories predict that people seek to interact with others to get information (Alchain & Demsetz, 1972; Burns & Stalker, 1961; Faust, 1994; Freedman, 1965). This selection model directly relates to the second gap addressed by this research, that is, how participants choose their interaction partners.

Factors Affecting Social Integration: The Influence Model

Motivated by the need to understand how a sense of connectedness in the online classroom can be created for students, the influence model in this dissertation study attempts to fill in some gaps that currently exist in the research literature, including understanding the cumulative effect of social interactions on students' sense of connectedness in online courses, the relationship between social presence and social integration, and other factors that might predict social integration in online courses. Drawing upon existing research on social integration in traditional learning and computer-mediated communication, this section uses social network literature to develop a model of factors that may affect social integration, student's perceptions of social connectedness (Frank, 1998).

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This influence model consists of a set of key concepts and principles to explain how social integration is affected by other factors. Some of these concepts bear names that have unique meaning in the social network analysis literature and thus need more explanation. This section thus begins with defining the key concepts and principles of the model.

Influence

Influence is the key concept underlying this model and is also one of the concepts that can be easily misunderstood because of its frequent use in other contexts. Influence, as used in the Influence Model, postulates a set of relationships. As mentioned earlier, the influence model is so named because it uses the influence variable to predict outcome.

Simply speaking, the influence concept suggests that a person's perception of her social integration could be a function of her social integration and other participants' perception of their social integration mediated by the extent of the existence of their relationship. In other words, an individual's perception of social integration may change as she interacts with others. The degree of the change varies according to the nature of their relationships. That is, if an individual's friends feel socially integrated, it is likely that the individual may also come to feel socially integrated.

It is reasonable to believe that individuals may feel the same level of social integration as the people with whom they most frequently interact. From this perspective, one's perception of social integration is determined or influenced by the perception of social integration of those with whom he or she interacts; the degree of influence is determined by the nature of interactions and relationships.

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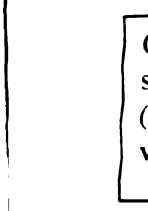
Technology Proficiency

The influence model includes technology proficiency as a confounding variable that might predict a person's sense of social integration. The reason for including technology proficiency in this model is because online communication is done through the use of technology; therefore, technology proficiency may affect a person's competence, willingness or comfort level in using technology for communication.

Social Skills and Other Personal Characteristics

Although there is little discussion or study in the literature of how social skills and other personal characteristics such as gender and race may affect a person's self-perception of social integration, these personal attributes may affect one's perception of integration because they affect one's social interactions. People with better social skills may be more likely to engage in more social interactions than those with weaker skills and thus more likely to be influenced by others. In addition, people may seek to interact with others with similar characteristics and thus share each other's sense of social integration. In this influence model, social skills and personal characteristics are considered as factors affecting social integration.



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The Complete Social Integration Model of Influence

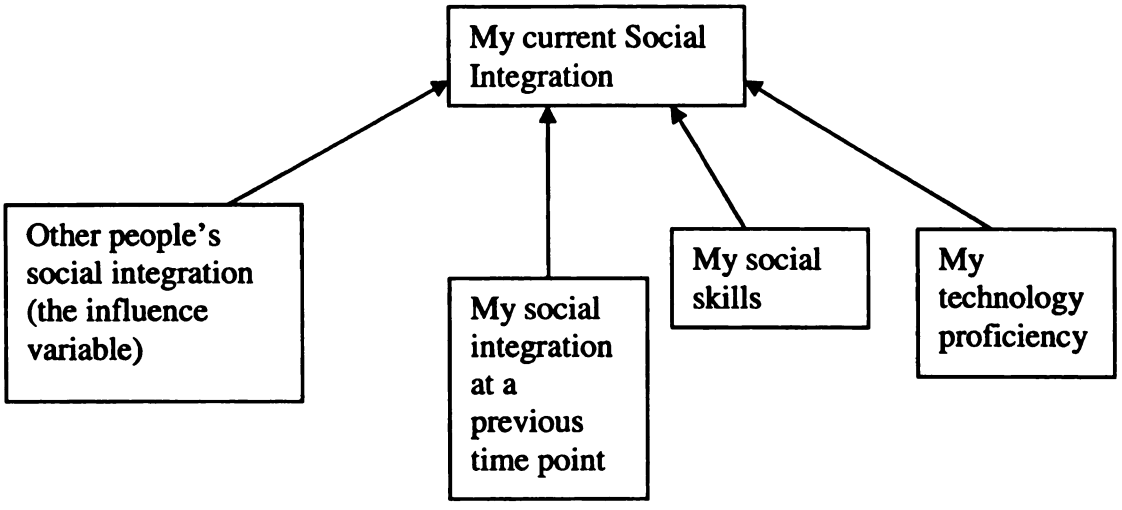

Figure 1: The Influence Model

To summarize, the *Influence Model of Social Integration* assumes that an individual student's perception of social integration is a function of his/her own perception plus any change to this perception caused by his/her interaction with others. The existence of online relationships may be confounded by participants' technology proficiency, social skills, and personal characteristics such as gender and race. The process through which members of a community, students and instructors of a class in the case of online education, influence one another is mediated through communication technologies.

This process may not be linear but in order to delineate the various components of the process, let's examine it as if it were. First, a member or student, *i*, senses the presence of another member, *i'*. Next, member i perceives the personal characteristics, knowledge, interests, beliefs and attitudes of member *i'*, as well as member *i's* self-perception of social integration. After that, member *i'* talks to member *i*, exchanging

information, opinions (related to the content of the class or otherwise), and artifacts of the class (like projects, papers, writing, etc.). These exchanges or social interactions can then lead to changes in member *i*'s attitude and beliefs. The types of beliefs or behaviors that may change as a result of influence are firstly, content related beliefs, such as concepts of theories, and ideas; secondly, attitude; and eventually, self-perception of social integration.

Factors Affecting the Formation of Social Ties: The Selection Model

According to the *Influence Model,* social integration is influenced by social interactions with other individuals in the same environment. Thus, with whom one interacts with has tremendous impact on one's sense of social integration. Hence a complete understanding of social integration must include an examination of factors that affect the formation of social ties, in other words, what influences one's decision about whom to make friends or interact with.

The process of choosing to interact or form a social tie with another member, in the words of social network analysis scholars, is called selection. The *Selection Model* explains the process with two principles. The first is the *balance seeking* principle or theory, which essentially states that people seek to be tied to individuals who are just like themselves. The second principle is the *information seeking* theory, which states that people choose to be tied to others to obtain information. These two basic principles point out potential factors that may affect a person's decision on whom to interact with in what context. Under principle one, members' social and physical attributes may play a bigger role while under principle two, members' knowledge and professional interest may have more impact since in this case people are looking for knowledge, not necessarily friends.

Since empirical research that examined the effects of social and physical attributes on social ties is limited and has been done mostly in the traditional learning environment, this study can only hypothesize from the literature review certain attributes that might affect people's choice of social ties in online courses. Whether social and physical attributes play the same role or maintain the same level of importance in online social interactions as in face-to-face settings remains to be seen because these attributes may be less visible to others. Moreover, because people's awareness of others is mediated by technology, some people will be more anonymous than others, and physical attributes may not be as important for deciding social interactions as other factors (Simonson, Smaldino, Albright, & Zvacek, 2000). Thus selection criteria for online participants to interact with each other as hypothesized in this dissertation study do not include physical attributes. Instead, the selection criteria may be attributes such as similar knowledge, social economic status (SES), gender, race, social presence, and use of technology, and social presence. Therefore, in this dissertation study, the following factors are proposed in the selection model:

Personal Characteristics

Personal characteristics include SES, gender, and race. As past literature on social networks in traditional learning settings found, there are strong correlations between SES, gender, race, and social interactions patterns. These characteristics, though may not completely be present in the online environment, may come through somewhat through CMC interactions. As the literature on CMC suggests, CMC is capable of producing very deep and honest reactions. This study will find out if personal

characteristics come through, and to what extent these come through in the online environment.

Knowledge

In the mean time, social network studies also point out that people who have the knowledge that others seek are also attractive social actors that others may want to interact with (Miller & Jablin, 1991). Conversely, actors who seek to interact with others may be people with the same interest, same social or academic goals, similar descriptive characteristics, and people who are seeking to become technically proficient.

Learning Environment

Personal interests have been proposed as a primary factor affecting online social ties or networks (Wellman, 2001, Wellman, Salaff, Dimitrova, Garton, Gulia, & Haythornthwaite, 1996). People seem to choose to interact or form social ties with those who are perceived to share the same interest. However, for the purposes of the dissertation study, personal interests have been narrowed to learning environment to refer to participants' perception of things in the learning environment, such as the instructor, the course content, the technologies.

Social Presence

Social presence may also be a huge factor that affects others' interaction choices. For example, if one is more present, they might attract more people to talk to. However, there is not much literature on how this affects interaction patterns. Do people talk to others of the same social presence or are they attracted only to people with high levels of social presence? In this dissertation study, this is put in the model to find out the effects of social presence on people's interaction patterns.

Restatement of the Research Questions

To summarize, the focal issue of this study is the development of social ties in online classrooms and the effect of social interactions on social integration or how students feel social connected to the online community or program. Social integration is considered key to both student retention, a persistent issue in distance education, and student satisfaction of the learning experience. Social integration is affected by how and with whom individuals interact in the online learning environment. Thus the dissertation narrowed its focus further to two questions:

1. What factors affect social integration in online education?
2. What factors affect who talks to whom in online education?

CHAPTER FOUR: METHOD

The previous chapter proposes two models and makes an argument for the different constructs in these models. This chapter discusses how these constructs are translated into variables through providing operational definitions for each of them. It then discusses the instruments used in the study followed by a discussion of sampling procedures and implementation of the instruments.

Participants

The participants of this study were college students in a large public university in the United States. All the virtual/distance instructors from this university, from a total of over 50 different undergraduate and graduate courses, were solicited. Eleven instructors responded positively, of which, only six classes actually had responses from students. Therefore, only six online classes were included in the final data analysis and report. The number of participants that responded from these classes ranged from 10 to 250 students.

These classes used different technologies for delivering the course content. Four of the classes were mainly content posted on websites, whereas the last two classes used course management software, including posting content, syllabus, discussion forums, emails, and chatrooms.

Description of the Instruments

Two surveys were used to collect data for this study. The first survey (See Appendix A) was administered at the beginning of the semester, whereas the second was administered at the end of the semester. Both surveys were divided into four sections, and were the same except that the second survey included three additional items in the second section on the respondents' level of engagement in the class.

The first section included items regarding respondents' ties, that is, who they talked to, and the medium they used to talk to each other. This helps answer research question one, as the participants were required to check the names of people in class whom they interacted with, and how often they had interacted, (from 1 to 5 times, 6 to 10 times, 11 to 20 times, and more than 20 times). Next, the survey asked participants to check the names of the classmates whom they knew best, and how they interacted with them, whether face to face, electronically, or other.

The second section asked participants how often they used different technologies each week. Technologies listed included web authoring, image editing, chat, typing, word processing, PowerPoint, email, web search, database, programming, phone, and video-conferencing. In addition, they were asked to rate their proficiency with various types of technology that might have been used in the online learning environment, from "don't know anything" to "can do without help", and their use of these technologies from spending "no time" to "more than an hour" each week. This section, together with the previous question on how they interacted with each other, provided data on the relationship between the use of technology and relationships.

The third section included 36 multiple-choice questions, which collected data on the respondents' social skills, social integration, academic integration, and social presence. This provided some information on the relationship between these elements and social network in the class.

The last section included items regarding respondents' demographic information. Specifically, these questions were multiple choice questions that asked the participants to identify their gender, ethnicity, SES, GPA, and for the online participants, whether they

had taken online courses before. This helped establish the aspects of participants' demographic information that could be matched to their social network positions.

Procedure

The instructors and participants were recruited at the beginning of the semester. Potential instructors were contacted for permission to collect data in their class. Two methods were used to solicit participation of students after the instructor gave the permission. First, email addresses were obtained from instructors who have agreed to have their classes participate in the study and then an email message explaining the study and inviting for participation was sent to each of the student. Second, an invitation email message was first sent to the instructor, who then forwarded it to the students.

The surveys were administered online. After students received the invitation email, which contained a Web URL that points to the Internet address of the surveys, they used a standard browser to complete the survey. The first survey was administered in about the third week of the semester. The second survey was administered by the end of the same semester. Student responses were automatically recorded to a secure database. The survey remained open for a week to allow students participation.

Defining the Constructs and Developing the Instruments

In this section, I provide the constructs with operational definitions and describe how they were developed to measure the construct reflected in each variable. First, I review the models and then proceed to address each construct.

Constructs in the Influence Model

To review, the influence model predicts social integration by postulating a relationship between social integration and social presence, influence, social skills and proficiency with technologies.

Social Integration. Social integration is the dependent or outcome variable in this model. It is the level of connectedness a student feels with the class. Literature defined social integration as students' involvement and engagement in social activities with other students and instructors. For the purposes of this study, social integration is operationalized in three ways: 1. the degree to which participants feel they are part of a class, 2. the degree to which they feel they belong to the dominant group in class, and 3. the degree to which they feel they have friends in class.

Items were devised to find out whether participants perceived themselves to be socially integrated by asking them whether they think they have friends, whether they see themselves as part of the class, and whether they think they belong to the dominant group in the class. These are three different items on the survey, and are kept separate because of the low alpha (α=0.59).

Influence. Following the social network analysis literature, the influence construct is defined as the consequent effect of interaction of a pair of ties. This is typically measured by the frequency of interaction and the cumulative attitudes of other participants. For example, person A interacts more frequently with person B than person C. Person B has a poor attitude toward the course whereas person C has a great attitude toward the course. The result of the cumulative effect of interaction with both person B and person C is that person A may be more influenced by person B's attitude as

compared to person C. In order to measure this construct, data must be collected on who the participants interact with, and their attitudes (in this case, their level of social integration). Then, the attitudes of every person that a participant interacts with are totaled to produce one value of influence for that participant. Going back to the same example, person A interacts with person B five times and with C two times; person B responds to the survey question on whether he/she feels connected to the class with a low level of 1 out of 5, whereas person C responds with a high level of 5 out of 5. Therefore, person A's influence level is a total of (frequency of interaction with person B) multiplied by (person B's level of connectedness) plus (frequency of interaction with person C) multiplied by (person C's level of connectedness).

To compute the influence variable, network data must be collected along with every participant's perception of social integration. In addition, two types of items were created to collect network data – one that asks how often they interact, and another that asks what medium they use in their interactions.

Social skills. The social skills construct (α=0.857005) was created to measure participants' social skills. The items measured how positive, gregarious, upbeat, and outgoing they were. As with the other constructs, these items would later be tested to ensure reliability.

Proficiency with Technologies. This construct (α=0.750470) was created to measure how comfortable or skillful participants are with technology. It is an average of time spent on different technologies, for example, email, video-conferencing, chat, and Microsoft word.

Constructs in the Selection Model

The constructs in the selection model are personal characteristics, knowledge, social skills and learning environment.

Personal Characteristics. Personal characteristics refer to SES, gender, and race are self-explanatory. They are demographic information. SES is determined by mother's level of education.

Knowledge. Knowledge refers to participants' knowledge of computer technologies, and of course content.

Learning Environment. Learning environment refers to participants' perception of the learning environment, including their perception of instructors, other participants, course content, and resources such as technology.

Social Presence. This is the same as in the influence model, where social skills is defined as the degree to people's ability to relate to others.

Variables – the Mathematical Models

Two different theoretical models were developed, one for each research question: the *Influence Model* and the *Selection Model.* These models are shown in figure 2. The Influence model is used to answer the research question "What interactions affect social integration in online education?" whereas the Selection Model is used to answer the research question, "What factors predict who talks to whom in online education?"

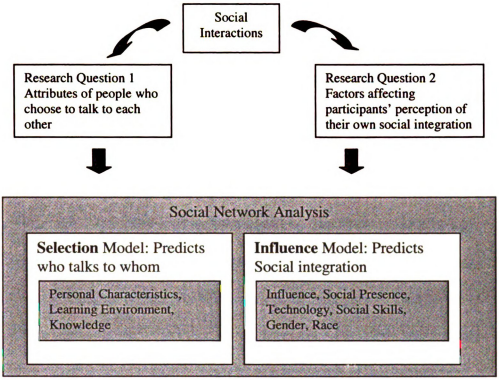

Figure 2: Two Models of Social Integration Analysis

The Influence Model

In the influence model, the outcome variable social integration is predicted by variables Influence, Social Presence, Technology, Social Skills, Gender, and Race. In the Selection model, the outcome variable social ties are predicted by variables Learning Environment, SES, Gender, Race, and Social presence.

The theories behind these two models are discussed in the previous chapter, but it may be useful to provide a brief review here. In social network analysis, influence refers to how a person's behavior changes in response to others they are tied to. A person's attitudes and believes are a function of his or her own attitudes and believes, and the attitudes and believes of other people they talk to, appropriated by the extent to which they interact. The higher the frequency and quality of interaction, the more a person's

attitudes and believes will be influenced by that interaction, whether positively or negatively. For example, if person 1 talks to person 2 and person 3, then the level of influence that person 1 receives from the relationship with person 2 and person 3 would depend on the extent of interactions between them, and how salient these people are. If person 1 interacts with person 2 three times in a semester and with person 3 twelve times, then it would be reasonable to suggest that person 3 has more influence on person 1's attitude and beliefs, such as perception of social integration. Based on social networks literature, person1's self-perception of social integration may approach person 3's self-perception of social integration as opposed to person 2's, because person 3 has more influence on person 1 than person 2. In other words, if person 3 has a high level of self-perceived social integration, then person 1 might have a high level of self-perceived social integration as a result. Therefore, the total influence that person 1 receives regarding his/her self-perception of social integration is derived from all his/her relationships, to the extent of their interactions.

The generic mathematical model of influence used to predict the outcomes of interactions on actors, is as follows:

$$y_{it} = \alpha \sum \left(w_{ii't-1 \rightarrow t} \, y_{i't-1} \right) + e_{it}$$

In this model, y_{it} represents the sentiments of actor i at time t, and $w_{ii't-1 \rightarrow t}$ represents the extent of the interaction between i and i' between t-1 and t. The influence of i' on i is then represented by $w_{ii't-1 \rightarrow t}$ multiplied by $y_{i't-1}$, and the influence of all others on i by $\Sigma \, (w_{ii't-1 \rightarrow t} \, y_{i't-1})$. At time t, the sentiments of actor i are a function of the sentiments of the others with whom the actor engages in interaction.

In order to model a person's self-perception of social integration in the online classroom, the above model has to be modified accordingly. As discussed in the previous section, social integration could be a function of the influence variable, social skills variable, technology variable, gender, and race. Therefore, a reasonable Social Integration Influence model would hypothesize that a person perceives himself or herself to be socially integrated depending to some extent on his or her interaction with others (influence), how socially skilled he or she is (social skills), how technically skilled he or she is (technology), gender, and race. Therefore, the mathematical model of Influence for Social Integration is elaborated below:

$$y_{it} = \gamma y_{it-1} + \rho \sum_{i'=1, i' \neq i}^{n} (\alpha_{ii't-1 \to t} + w_{ii't-1 \to t}) y_{i't-1} + \beta_1 gender_i +$$
$$\beta_2 social\ skills_i + \beta_3 class1_i + \beta_4 class2_i + \beta_5 class3_i + \beta_6 class4_i +$$
$$\beta_7 class5_i + \beta_8 class6_i + \beta_9 caucasian\ american_i + \beta_{10} african\ american_i +$$
$$\beta_{11} asian\ \ american_i + \beta_{12} native\ american_i + \beta_{13} race\ other_i +$$
$$\beta_{14} \text{technology}_i + e_{it}$$

where:

y_{it} is student *i's* perception of his/her social integration at time *t (end of the semester),*

which is referred to as Yvar_t throughout the rest of the paper,

$y_{i't-1}$ is student *i' 's* perception of his/her social integration at time *t-1 (beginning of the semester),*

y_{it-1} is student *i*'s perception of his/her social integration at time *t-1 (beginning of the semester),*

$w_{ii't-1 \to t}$ is the extent or existence of a relation between individuals *i* and *i'* between time *t-1* and *t*, as perceived by *i*, (indicated by the number of times each participant talked to other members of the class)

$\alpha_{ii't-1 \to t}$ is the extent or existence of a relation between individuals *i* and *i'* between time *t-1* and *t*, as perceived by *i*, (indicated by the quality of their communication)

$gender_i$ is student *i's* gender,

$socialskills_i$ is student *i's* social skills between time *t-1* to *t*, as perceived by *i*,

$class1_i$, $class2_i$, $class3_i$, $class4_i$, $class5_i$, $class6_i$ is student *i*'s class membership,

caucasian american$_i$, *african american*$_i$, *asian american*$_i$, *native american*$_i$, and *race other*$_i$ is student *i*'s race,

$technology_i$ is student *i*'s use of technology, and

e_{it} is the error for student *i* at time *t*.

This model suggests that student *i*'s beliefs at time *t* are influenced by the mean of the beliefs of the people that student *i* interacts with between time *t-1* and *t*, student *i's* beliefs from time *t-1*, personal characteristics of student *i'*, and the set of possible confounding variables, including social skills, technology, class, gender, and race. For example, a given person's part/friends, is a function of the beliefs/friends variable at a previous time point. Therefore, a person's self-perception of social integration is a function of the self-perception of social integration of friends that this person talks to, controlling for other variables.

The Selection Model

The second research question is addressed by using the selection model in social network analysis. This model helps analyze the characteristics that draw people to each other, choosing who they want to talk to. According to the model of Selection, that is, people's choice of friendship in an online classroom, may be a function of their knowledge/expertise, social presence, personal characteristics, and learning environment. The mathematical model of selection may look like this:

$$\log\left[\frac{p\left[w_{ii't-1\to t}=1\right]}{1-p\left[w_{ii't-1\to t}=1\right]}\right]=\beta_0+\beta_1\left|x_{it-1}-x_{i't-1}\right|+\beta_2\left|y_{it-1}-y_{i't-1}\right|$$
$$+\beta_3\left|z_{it-1}-z_{i't-1}\right|+\beta_4\left|x_{it-1}-x_{i't-1}\right|\left|y_{it-1}-y_{i't-1}\right|\left|z_{it-1}-z_{i't-1}\right|$$

or

$$\log\left[\frac{p\left[friendship_{ii't-1\to t}=1\right]}{1-p\left[friendship_{ii't-1\to t}=1\right]}\right]=\beta_0+\beta_1\left(knowledge_{ii'}\right)+\beta_2\left(learning\_environment_{ii'}\right)+$$
$$\beta_3\left(social\_presence_{ii'}\right)+\beta_4\left(personal\_characteristics_{ii'}\right),$$

where $friendship_{ii't-1\to t}$ represents whether actor i' listed i as a friend during the time interval $t-1\to t$.

The expression:

$$\beta_0+\beta_1\left(knowledge_{ii'}\right)+\beta_2\left(learning\_environment_{ii'}\right)+\beta_3\left(social\_presence_{ii'}\right)+$$
$$\beta_4\left(personal\_characteristics_{ii'}\right)$$

represents the characteristics of the pairs that are hypothesized to be significant, where:

$knowledge_{ii'}$ is similarity of knowledge between actors i and i',

$learning\_environment_{ii'}$ is similarity of interest between actors i and i',

personal_characteristics $_{ii'}$ is similarity of personal characteristics between actors *i* and *i'*.

In other words, this model assumes that pairs with the same level of knowledge, the same interests, the same level of social presence, and the same personal characteristics will be more likely to choose to talk to each other.

CHAPTER FIVE: RESULTS AND FINDINGS

This chapter presents the results of the study. The results are organized according to the research questions. Before reporting data for the research questions, I first present an overview of the data set.

The data sets are described in Table 1. There are 6 classrooms of participants, with one graduate and five undergraduate classes. The size of the classes varied from 25 to 150, and the discipline of the classes were different as well. The diversity was both intentional and serendipitous. The original goal was to recruit as many students and classes from a wide range of disciplines and academic levels. Thus all online courses were invited to participate in this study. Due to various reasons, many classes did not participate. Of those who participated, the response rates also varied from 16% (24 participants out of 150) to 49.4% (43 participants out of 87).

Table 1

Background Information of Data Set

Class	Department	Level	Enrolled Students	Responded Students	% Responded
1	Education	Graduate	25	8	32
2	Business	Undergraduate	150	24	16
3	Nursing	Undergraduate	39	9	23.1
4	Telecommunications	Undergraduate	72	33	45.8
5	Telecommunications	Undergraduate	57	25	43.9
6	Telecommunications	Undergraduate	87	43	49.4

What Factors Affect Social Integration in Online Education?

According to the *Influence Model,* participants' social integration at the end of the semester can be predicted by a combination of their perception of their social integration

at the beginning of the semester, and the process of influence, that is, the degree to which their attitudes and beliefs are influenced by other members of the class. It also suggests that the relationship between those with whom a student talks and a students' own social integration could be confounded with the student's social skills, technology proficiency, class membership, gender and race. Therefore, social integration at the end of the semester (time *t*) is treated as the dependent variable in the analysis, with social integration at the beginning of the semester (time *t-1*) as well as *Influence* as the independent variables.

In this analysis, all six classes were combined. Three items were used to compute social integration. Each of these variables is single items from the survey: *Part* (i.e., I feel that I am a part of this class), *Dominant* (i.e., I belong to the dominant group in this class), and *Friends* (i.e., I have friends in this class).

To compute *Influence*, two different sets of data were used: *Network1* (The number of times each participant talked to other members of the class) multiplied by other members' social integration and *Network2* (The type of communication i.e., face-to-face, electronic, or other) multiplied by other members' social integration. Network2 was interpreted as the quality of interactions with face-to-face on one end of the spectrum, electronic on the other end of the spectrum, and "other" being middle of the spectrum, such as telephone. These were recoded into a scale of 1 to 3, where 1 is electronically, 2 is other, and 3 is face-to-face. Since there are three variables and 2 networks, there are a total of six different models for predicting participants' perception of social integration at the end of the semester, as seen in the descriptive statistics in Table 2.

Table 2
Descriptive statistics for factors related to social integration at the end of the semester

Variable	N	Mean	Std Dev
Classroom			
1	8		
2	24		
3	9		
4	33		
5	25		
6	43		
gender			
Male	98		
Female	45		
race			
Caucasians	97 (68%)		
African Americans	15 (10%)		
Asians	26 (18%)		
Hispanic	1 (.7%)		
Native Americans	3 (2 %)		
Other	1 (.7%)		
Common Variables			
influence (*wy*)	121	36.9	58.6
technology proficiency	146	3.4	0.8
Social Skill	146	3.3	0.5
Social Integration at the beginning of the semester (Yvart-1)			
Part & Network1 model	145	3.0	0.7
Part & Network2 model	145	3.0	0.7
Dominant & Network1 model	144	3.2	1.3
Dominant & Network2 model	144	3.2	1.3
Friends & Network1 model	144	2.9	1.0
Friends & Network2 model	144	2.9	1.0

In addition to *influence*, and *social integration* variables, confounding factors *Technology*, *Social Skills*, *Gender*, and *Race* were included in the analysis. The

descriptive statistics for these variables are displayed in Table 2. *Influence* at the end of the semester was an average of 36.89 with a standard deviation of 58.6. *Social integration* at the beginning of the semester ranged from 2.93 to 3.22 with standard deviations from 0.72 to 0.99, depending on the model. This included *Part,* which had a mean of 3.05 and a standard deviation of 0.72, *Dominant*, which had a mean of 3.2 and a standard deviation of 1.28, and *Friends* had a mean of 2.93 and a standard deviation of 0.99.

Technology is an average of time spent on technologies including chat, email, video conferencing, web authoring, database, word-processing, internet research, powerpoint, typing, image editing, programming, and phone. Participants indicated their use of different technologies on a scale of 1 to 8. The participants spent an average of 30 minutes to 1 hour on technology, which was a mean of 3.4 and a standard deviation of 0.84 (α=0.750470).

Social Skills is an average of a list of items assessing the degree to which a respondent is socially skilled: I am upbeat and have a positive attitude; I usually like/get along with new people; I make an effort to be courteous; I am comfortable communicating my feelings verbally; I am successful in hobbies and activities that involve group interaction; I enjoy listening to people; I feel comfortable interacting with the people in this class. The participants reported an average of 3.34 level of social skill with a standard deviation of 0.45 (α=0.857005).

Of the six models used in this analysis to predict participants' social integration at the end of the semester, the first two had moderate explanatory power (R^2 = 0.36 and 0.35), the second two had lower explanatory power (R^2 = 0.23, and 0.23), whereas the

last two had the highest explanatory power ($R^2 = 0.57, 0.52$). The results are displayed in Table 3.1, 3.2, and 3.3.

Table 3.1
Interactions that affect social integration at the end of the semester

Independent Variable	Parameter Estimate	Standard Error
Model 1: Part & Network1		
Social Integration at the beginning of the semester (Yvar t-1)	0.32**	0.10
Influence (Wy)	0.00222	0.00116
Technology Proficiency	0.03	0.077
Social Skill	0.10	0.14
Gender	-0.14	0.17
Race 1	0.73	0.70
Race 2	1.02	0.73
Race 3	0.79	0.72
Race 4	0.88	0.96
Race 5	1.65	0.80
Race 6	0.00	--
Classroom 1	-0.05	0.27
Classroom 2	-0.10	0.25
Classroom 3	0.45	0.30
Classroom 4	0.08	0.18
Classroom 5	0.20	0.19
Classroom 6	0.00	--
Intercept	0.83	0.82
R-square	0.31	
Model 2: Part & Network2		
Social Integration at the beginning of the semester (Yvar t-1)	0.34***	0.10
Influence (Wy)	0.00178	0.00101
Technology Proficiency	0.03	0.08
Social Skill	0.12	0.14
Gender	-0.14	0.17
Race 1	0.73	0.70
Race 2	1.06	0.73
Race 3	0.79	0.71
Race 4	0.87	0.96
Race 5	1.81	0.80
Race 6	0.00	--
Classroom 1	-0.04	0.28
Classroom 2	-0.02	0.24
Classroom 3	0.47	0.30
Classroom 4	0.06	0.17
Classroom 5	0.22	0.19
Classroom 6	0.00	--
Intercept	.72	.81
R-square	0.31	

Note: Yvar t-1 is social integration at time t-1; wy is influence
**p≤.05 **p≤.01 ***p≤.001*

The first model (table 3.1) combined the social integration variable *Part* (I feel that I am a part of this class) with influence data *Network1*. Here, the *Influence* variable

wy is the number of times an actor talks to each member in class multiplied by their perception of the degree to which they feel they are a part of their class. This overall model had an R^2 of 0.31, with participants' perception of their *social integration at the beginning of the semester* (*Yvar t-1*) being significant at $p \leq .01$. That is, participants' perception of whether they feel they are a part of their class at the end of the semester can be predicted by the participants' perception of their social integration at the beginning of the semester (*Yvar t-1*). Specifically, with one unit of *Yvar t-1* predictor, there is 0.32 increase in the outcome *Yvar*. In this model, one unit of increase in *influence* leads to 0.00222 units of increase in social integration (*part*); one unit of increase in *technology proficiency* leads to 0.03 units of increase in social integration (*part*); and one unit of increase in *social skills* leads to 0.10 units of increase in social integration (*part*).

The second model (table 3.1)is similar to the first model in that it uses the *Part* variable for social integration. However, instead of using *Network1* data to compute influence, this model computes influence data by multiplying data from *Network2* (the quality of interaction between participants as indicated by the extent to which they interacted electronically versus face to face with the people they know best), and the other members' perception of the degree to which they feel they are a part of their class). Results for this model are similar to the first model, with an explanatory power of R^2=0.31. Similar to the first model, this model showed that the variable was significant in predicting participants' perception of their social integration, or their perception of whether they "feel like a part of this class" at the end of the semester: *yvar t-1* ($p \leq .001$). In this model, one unit of increase in *influence* leads to 0.00178 units of increase in social integration (*part*); one unit of increase in *technology proficiency* leads to 0.03 units of

increase in social integration (*part*); and one unit of increase in *social skills* leads to 0.12 units of increase in social integration (*part*).

Table 3.2
Interactions that affect social integration at the end of the semester

Independent Variable	Parameter Estimate	Standard Error
Model 3: Dominant & Network1		
Social Integration at the beginning of the semester (Yvar t-1)	0.30**	0.09
Influence (Wy)	0.00122	0.00196
Technology Proficiency	0.32*	0.13
Social Skill	-0.32	0.25
Gender	-0.28	0.29
Race 1	0.92	1.22
Race 2	1.37	1.27
Race 3	0.98	1.24
Race 4	0.88	1.67
Race 5	1.06	1.40
Race 6	0.00	--
Classroom 1	0.66	0.48
Classroom 2	-0.01	0.41
Classroom 3	0.78	0.51
Classroom 4	0.19	0.30
Classroom 5	0.25	0.34
Classroom 6	0.00	--
Intercept	1.28	1.42
R-square	0.20	
Model 4: Dominant & Network2		
Social Integration at the beginning of the semester (Yvar t-1)	0.33***	0.09
Influence (Wy)	0.00095	0.00167
Technology Proficiency	0.31	0.24
Social Skill	-0.35	0.24
Gender	-0.18	0.28
Race 1	0.48	0.49
Race 2	0.02	0.39
Race 3	0.62	0.51
Race 4	0.10	0.29
Race 5	0.21	0.34
Race 6	0.00	--
Classroom 1	0.48	0.49
Classroom 2	0.02	0.39
Classroom 3	0.62	0.51
Classroom 4	0.10	0.29
Classroom 5	0.21	0.34
Classroom 6	0.00	--
Intercept	0.31	1.40
R-square	0.21	

Note: Yvar t-1 is social integration at time t-1; wy is influence
**p≤.05 **p≤.01 ***p≤.001*

The third model (as displayed in table 3.2) uses the *dominant* variable (I belong to the dominant group in this class) for social integration and computes the *Influence* variable by multiplying *Network1* (the number of times I talk to each member in class) and other members' perception of the degree to which they belong to the dominant group in their class. This overall model has an explanatory power of R^2=0.20. This model is similar to the first two models in that *social integration at the beginning of the semester* is statistically significant here ($p \leq .001$). However, the *technology proficiency* variable is also significant here ($p \leq .05$). In this model, one unit of increase in *influence* leads to 0.00122 units of increase in social integration (*dominant*); one unit of increase in *technology proficiency* leads to 0.32 units of increase in social integration (*dominant*); and one unit of increase in *social skills* leads to -0.32 units of increase in social integration (*dominant*).

The fourth model (table 3.2) is similar to the third in that the *dominant* variable is combined with *Network2*. The explanatory power, R^2 (0.21), is also close to that in the third model. In this model, however, the predictor *technology proficiency* is not statistically significant. Also, the *influence* variable, that is, whether the participants interact with each other electronically, face to face, or through other means, was not significant in predicting the degree to which they perceive that they "belong to the dominant group in this class." In this model, one unit of increase in *influence* leads to 0.00095 units of increase in social integration (*dominant*); one unit of increase in *technology proficiency* leads to 0.31 units of increase in social integration (*dominant*); and one unit of increase in *social skills* leads to -0.35 units of increase in social integration (*dominant*).

Table 3.3
Interactions that affect social integration at the end of the semester

Independent Variable	Parameter Estimate	Standard Error
Model 5: Friends & Network1		
Social Integration at the beginning of the semester (Yvar t-1)	0.39***	0.07
Influence (Wy)	0.00268*	0.00118
Technology Proficiency	0.01	0.07
Social Skill	0.40**	0.14
Gender	-0.23	0.15
Race 1	0.03	0.65
Race 2	0.37	0.68
Race 3	0.48	0.66
Race 4	0.23	0.90
Race 5	-0.51	0.75
Race 6	0.00	--
Classroom 1	0.67	0.26
Classroom 2	-.07	0.22
Classroom 3	0.13	0.28
Classroom 4	0.11	0.16
Classroom 5	0.19	0.18
Classroom 6	0.00	--
Intercept	0.45	0.76
R-Square	0.50	
Model 6: Friends & Network2		
Social Integration at the beginning of the semester (Yvar t-1)	0.44***	0.07
Influence (Wy)	0.00147	0.00113
Technology Proficiency	-0.002	0.074
Social Skill	0.41*	0.14
Gender	-0.20	0.15
Race 1	0.06	0.66
Race 2	0.37	0.69
Race 3	0.41	0.67
Race 4	0.17	0.90
Race 5	-0.32	0.76
Race 6	0.00	--
Classroom 1	0.58	0.27
Classroom 2	-0.18	0.21
Classroom 3	0.06	0.28
Classroom 4	0.01	0.16
Classroom 5	0.18	0.18
Classroom 6	0.00	--
Intercept	0.32	0.77
R-Square	0.47	

Note: Yvar t-1 is social integration at time t-1; wy is influence
**p≤.05 **p≤.01 ***p≤.001*

The fifth model (as displayed in table 3.3) uses *Friends* (I have friends in this class) as the social integration variable, combined with *Network1*. It has an R^2 of 0.49,

with three significant predictors: *Social integration at the beginning of the semester, influence, and social skill ($p \leq .01$).* The degree to which participants perceive they have friends in their class is significantly predicted by each of the following: *influence ($p \leq .05$)*, which is the product of the frequency of participants' interaction with other class members and other class members' perception of whether they "have friends in this class", participants' perception of their *social integration at the beginning of the semester ($p \leq .001$),* and participants' *social skills ($p \leq .01$).* In each of these assessments, participants' gender, race, technology proficiency and the classes they are in, were controlled for. In this model, one unit of increase in *influence* leads to 0.00268 units of increase in social integration (*friends*); one unit of increase in *technology proficiency* leads to 0.01 units of increase in social integration (*friends*); and one unit of increase in *social skills* leads to 0.40 units of increase in social integration (*friends*).

Finally, in the sixth model (table 3.3), social integration is indicated by the *Friends* variable, and has an explanatory power of R^2=0.47. The significant predictors are similar to the fifth model, except that *influence* is not statistically significant and *social skills* is. Specifically, *influence (wy)* – the type of interaction, that is, whether they interact electronically, face to face, or through other means, multiplied by other members' perception of the degree to which they have friends in this class, was not significant in predicting social integration indicated by whether they have friends in their classes. However, the variable, *social skills ($p \leq .05$)*, is significant in predicting whether they have friends in their classes. In this model, one unit of increase in *influence* leads to 0.00147 units of increase in social integration (*friends*); one unit of increase in *technology*

proficiency leads to 0.002 units of increase in social integration (*friends*); and one unit of increase in *social skills* leads to 0.41 units of increase in social integration (*friends*).

To summarize, six models were used in the analysis of the factors that affect social integration in online education, using a variety of predictors including *influence*, and *social integration* variables, and confounding factors *Technology Proficiency*, *Social Skills*, *Gender*, and *Race*. Of these variables, *social integration* at the beginning of the semester was consistently significant, *influence* was consistently positive, with relatively high levels of variance explained by the models, and *Social Skills* is consistently positive and significant in predicting whether participants perceived they had friends in their classes.

What Factors Predict Who Talks to Whom in Online Education?

To answer this question, all the variables in each of the six classes were analyzed using the P2 model in Stocnet (Boer, Huisman, Snijders, & Zeggelink, 2003), a software for the advanced statistical analysis of social networks. "The purpose of the P2 model is to test the effects of actor and/or dyadic attributes on the ties observed in a directed network, controlling for reciprocity and for differences between actors in activity and popularity" (Stocnet, version 1.4.) There were 66 variables in this analysis, all of which are listed in the Appendix B. These variables were analyzed in relation to the receiver (the person who is selected). That is, the variables are the receiver's characteristics. The data analysis shows that there are eight variables that are significant at $p<.05$ in predicting who talks to whom in an online class as shown in table 5. Each of these eight variables fall into the categories specified by the selection model: *knowledge, interest, social presence, personal characteristics*. First, participants are more likely to

Table 4

Significant Factors that Predict Who Talks to Whom

Class	Factors (model variables)	Variable	Coef	Std Error
6	Academic Goal	Agoal My goal is to achieve an "A" for this class	-0.5730***	0.1692
6	Social Integration	Part I feel I am a part of this class	-0.3812*	0.1929
6	Social Integration	Dominant I belong to the dominant group in this class	-0.4832***	0.1407
6	Knowledge	Skilled I am very skilled with computers	0.3244*	0.1600
6	Knowledge	Time image Image editing	-0.2824**	0.2044
1	Knowledge	Confident I am confident of the subject matter in this class.	3.1283*	1.1243
2	Knowledge	Time email	-0.2063*	0.0914

*$p \leq .05$ **$p \leq .01$ ***$p \leq .001$

talk to people with similar academic goals (*Agoal* in class 6), or that that are less likely to talk to people with different academic goals. Second, they are more likely to talk to people who are just as socially integration, or that they are less likely to talk to people who are not as socially integrated are they are (*part, & dominant*). Third, they are more likely to talk to people who are not as skilled in computers as they are (*skilled*), and who have different levels of confidence in the subject matter as they do. Finally, the greater the difference in the time spent on email and image editing, the less likely they are to talk

to each other (*timeEmail & timeImage*), or the more similar, the more likely they are to talk. There were no significant variables in the "learning environment" category, or the "social presence" category. Table 4 displays the significant results for all six classes of data. These variables are mostly from class 6, except for *Confident and TimeEmail*, which are from Classes 1 & 2. Details on other variables are available in the Appendix.

In summary, 66 different variables taken from the survey were analyzed to delineate factors that predict who talks to whom. Of these variables, six were significant predictors that two people online would select each other to interact with. Specifically, the significant variables are related to academic goal, social integration, and knowledge.

CHAPTER SIX: CONCLUSION AND DISCUSSIONS

The purpose of this study was to find out how interactions in the online learning environment affect social integration, and how people choose whom they want to talk to. Literature expounds on the advantages of social integration, predicting a relationship between social integration and student attrition. This study hypothesized a relationship between social integration and influence, that is, the effect of students' interactions with other people in the class. The results show that influence and participants' use of computer mediated communication technologies are significant predictors of their perception of their social integration at the end of the semester only in some models, controlling for participants' perception of their social integration at the beginning of the semester, their social skills and the class they are in; whereas social presence is a consistent predictor of their perception of their social integration at the end of the semester controlling for the same variables. In this final chapter, I discuss in more detail the findings in both technical terms and their implications in educational terms.

How Social Interactions Affect Social Integration

All of the statistical models that were explored have moderate explanatory power, ranging from $R^2 = 0.31$ to 0.50, except for the models where social integration is indicated by participants' perception of their feeling that they are the dominant group in class, which only has an R^2 of about 0.20. This may mean that being part of the dominant group in class may not be a good indicator of social integration, and that this particular item may not best represent social integration. Students who feel that they are part of this group may not feel socially integrated if this group is a minority, for example. The models in which social integration is indicated by participants' perception of the degree

to which they have friends, have more explanatory power than those indicated by whether they feel they are part of the class, with a difference of approximately 18% to 21%.

While the effect of influence is consistently positive and small, it is statistically significant in predicting social integration at the end of the semester in only one model. This model, however, has the highest percent of total variance explained, making this model more reliable to predict social integration than other models. In this model, Influence as measured by the frequency of interaction among participants (*Network1*) is a significant predictor of participants' perceptions of their social integration at the end of the semester. This is consistent with the social networks literature that friends' attitudes and beliefs at a previous point in time will affect a person's attitudes and beliefs at a future point in time (Frank & Fahrbach 1999; Marsden and Friedkin, 1994). When participants interact with others who perceive themselves to be more socially integrated, the participants also perceive themselves to be more socially integrated. This is also consistent with theories on social integration and student attrition in traditional (face-to-face) educational contexts (Spady, 1954; Tinto, 1993), which predict social integration as an outcome of positive interactions with others. This result has bridged the gap between social networks literature and student attrition. It also suggests that the same theories apply to social integration in distance education.

Social Skills was significant in predicting whether participants perceived they had friends in the learning setting, but not significant in predicting whether they felt like they were a part of their class, or whether they felt like they belonged to the dominant group in their class. This means that even though people with higher levels of social skills may have more friends, they may not feel they are part of the class. A closer look at the items

used to compute this variable helps clarify this point. Among the items used to compute *social skills*, some asked participants whether they usually have an upbeat attitude, how much they enjoy group interactions, and communicating verbally. In other words, a person could be highly skilled in social situations, and yet still feel they are not socially integrated in the online environment. Perhaps online social skills need to be redefined, but it is clear that just because a person is socially skilled, this person will be more socially integrated in the online environment.

Technology Proficiency was insignificant in predicting whether students feel they were a part of the class, or whether they had friends; but it was significant in predicting whether they felt like they were a dominant group in the class. *Technology Proficiency* is computed by the amount of time participants spent on various technologies, including word processing, and programming. Since some of these are very isolated activities, they it is not surprising that the more time they spend on these activities, the less socially integrated they feel. However, those that used more technology may feel more dominant in the class because of the high level of technology use in online classes.

Race and *Gender* are not significant predictors of participants' perception of their social integration. That is, whether the participants perceive themselves to be socially integrated at the end of the semester is not affected by their race and gender controlling for perception at the beginning of the semester. Male and female participants do not differ in their perception of their social integration. The different racial groups do not differ in their perception of their social integration either. Perhaps this means that minorities did not cross racial boundaries, for if they did, they might feel more socially integrated, since they would not be limited to their own race anymore? If so, this would

be slightly inconsistent with previous literature on face-to-face educational settings, which suggests that social relations do not cross racial and gender boundaries. For example, in the face-to-face setting, it would be more likely for a minority group to feel less socially integrated. Herein lies one of the differences between face-to-face and distance education. In distance education, people are more anonymous, and their physical attributes may not have as much impact on social relationships as in face-to-face settings. Therefore, people may seem more gender and race neutral. This is further accentuated by the fact that *Race* and *Gender* also do not contribute much to the overall variance explained by the models used to predict social integration, accounting for only 2% to 4% of the total variance explained.

Discussion of Social Interaction Selection Model: Who Talks to Whom?

Literature on how people choose who they want to talk to in face-to-face education settings suggested that people tend to choose to interact with those of the same socio-economic levels, the same race, and gender. Results of this analysis on distance education are contrary to this. The variables that predict who talks to whom are mostly from class 6, which is the class with the highest response rate at 49%. The other classes, unfortunately, had smaller response rates, and did not yield any significant results. Therefore, the results were inconclusive for those classes. In class 6, the variables that were significant were Academic goal, social integration, and knowledge. In classes 1 and 2, knowledge is also a significant factor. In short, participants seemed to select who they talk to differently in online learning environments than in face-to-face learning environments.

Academic goal has not been found to be a significant predictor of who talks to whom in face-to-face classrooms, but it is significant here, in an online classroom. Participants with the different academic goals tend to report not talking to each other, and participants with similar academic goals tend to report talking to each other. The greater the difference in their academic goals, the less likely they indicate talking to each other; or the more similar, the more likely they indicate talking to each other. Consistent with social network literature (Cherny 1999; Muffo & Connor, 1987; Romiszowski & Mason, 2001), one of the differences between face-to-face and distance education is that students' social behavior is different, that online participants tend to be more knowledge and interest oriented than face-to-face participants. Results in this study suggest that online participants do not choose their friends based on physical attributes such as gender and race, but based on knowledge and interest, such as academic goals.

There are factors related to the social integration of the participants that have been found to be significant. One of them is *part*, which has to do with whether the participants feel they are a part of their class. In this case, the parameter estimate is negative, which means that the greater the difference in *part*, the less likely they are to talk to each other; or the greater the similarity, the more likely they are to talk to each other. That is, participants who feel they are part of their class would be less likely to indicate talking to participants who feel they are not part of their class, and vice versa. Given that the findings in the influence model were that participants who talk to each other are influenced by each other, it is reasonable to also find that same pattern here in the selection model. Similarly, another social integration variable *dominant* was found to be statistically significant, predicting that the greater the difference in this factor, the less

likely the participants are to talk to each other. That is, participants who feel they are part of the dominant group in class would be less likely to indicate talking to participants who feel they do not belong to the dominant group in class.

Knowledge seems to be a major factor in predicting who talks to whom online. Several knowledge variables have been found to be significant: 1. computer skills, 2. time spent on technologies, and 3. confidence with the subject matter. Like academic goals, knowledge has not been found to be a significant predictor of who talks to whom in face-to-face classrooms, but it is significant here, in an online classroom. First, the more similar participants are on their level of computer skills, the less likely they are to talk to each other. People with high computer skills tend to talk to others with low computer skills, and vice versa. This could be another sign that one of the reasons online students talk to one another is to get help from people who are more proficient in technology. Second, people who spent more time on technologies are more likely to talk to others who spent more time on technologies and vice versa. The two technology variables that were significant were email and image editing, which indicated that these participants were perhaps working on image editing as part of their class, and were perhaps using email to communicate with one another. That is, the more time they spent on emails and image editing, the more likely for them to indicate talking to each other. Third, participants who are more confident in the subject matter tend to indicate talking to others who are less confident in the subject matter. This is again consistent with the literature on social networks, stating that online participants tend to interact with others to based on the motivation for academic growth and interests rather than physical

attractions. Therefore, online participants seek out others who are more confident in the subject matter, perhaps seeking help from these people.

Contrary to my predictions, the variables for social presence did not seem to be significant in predicting selection. That is, people who are more socially present are not any more likely to be selected by others who are also socially present. In other words, they may be selected by other participants no matter how socially presented they are. The participants impose a set of selection criteria on who they want to talk to besides being socially present. However, social presence could affect whether they perceive *Race*, *MotherEd*, *GPA*, *SuccessGroup*, or *Upbeat* and *Courteous*. Therefore, the role of social presence in selection criteria may be mediated by these other factors.

Implications

This dissertation attempts to understand the intricacies of social interactions in distance courses to address the traditional problem of student retention and lack of social interactions and student engagement in distance education, and improving the learning environments to maximize students' success. The sociological perspective offers the instructors, designers and administrators an opportunity to examine the learning environment in order to maximize student success, rather than having students cultivate personal characteristics for success as suggested by the psychological perspective. According to the sociological perspective, every learning environment has a unique propensity for student success, or student attrition. Through examining the learning environment, we could find out factors of student success through looking at social interaction patterns, since student success depends on social interactions, supported by

the social learning theories, and the student attrition theories (Brown & Daguid 2000, Tinto 1993, Yalama & Aydin, 2004).

The social network analysis approach used in this study has added another dimension to the study of social interaction patterns compared to past research. Firstly, it takes into account the dyadic properties of relationships to further understand social interaction patterns, and student attrition. Past research focused on students' self-perception of social integration without considering how the frequency and quality of interactions with others may affect that self-perception. By taking this into account, this study was able to examine the factors of social integration not just through students' self-perception of social integration, but also through studying how interacting with others affect their self-perception of social integration, which was called the Influence variable in this study. Secondly, social network analysis provides a way of quantifying relationships and ties which allows us to how people choose their interaction partners by examining the personal characteristics which attract people to each other in the online environment.

Influence was found to be consistently positive in predicting social integration at the end of the semester and even statistically significant in a particular model where influence was defined as the frequency of interaction with others, and social integration as the number of friends a student has in class. If people influence each other, and their sense of connectedness with the class at the end of the semester is predicted by their sense of connectedness with the class at the beginning of the semester, then beginning differences would become accentuated unless there's some intervention.

Student attrition theories suggest that students who are not socially integrated tend to drop out (Tinto, 1993). Since social integration is a key factor in students' academic retention (Tinto, 1993), and students' perception of their social integration is affected by the frequency and quality of interactions with others, it implies that there may be a connection between the influence people get from their social interactions and student attrition. The implication is that if students are left to interact by themselves without any form of intervention, they may become influenced by negative attitudes, leading them to become dissatisfied or feel disconnected with the class. More research would be needed to study the impact of imposed structure on social integration.

The social network analysis approach also enabled the study of which makes them more motivated or attracted to interact with each other online. Researchers hypothesize that online social networks would be formed based on personal interests, knowledge, and particular personal characteristics (Wellman, 2001; Wellman, Salaff, Dimitrova, Garton, Gulia, & Haythornthwaite, 1996). The social interaction selection model examined this aspect of social interaction patterns online, and confirmed past research. It brought out a main difference between distance and face to face classrooms, which is the impact of physical attributes in predicting social relationships. The fact that gender and racial groups do not differ in their perceptions of their social integration may be an important consideration for face-to-face classrooms where physical attributes are a predictor of social relationships. Instructors in the face-to-face classrooms may wish to use computer mediated communication technologies to capitalize this to increase social integration, and level out physical differences.

In conclusion, this dissertation focused on social interaction patterns and how social interactions affect social integration, which ultimately affects student success in online learning environments. The study showed that people are influenced by their social interactions with each other, and they choose to interact with people like themselves, which implies that intervention is necessary or the beginning differences would become accentuated. Social interactions are important as they help students share and propagate knowledge in the online learning community, and help them feel more socially integrated. Understanding social integration may help clarify issues of student drop out and the building of online learning communities, which may be valuable to educators, researchers, and administrators in this field.

Limitations of the Study and Suggestions for Future Studies

The findings of this study should be only considered preliminary and suggestive because of a number of limitations. First, the low response rate posed a serious threat to the validity of the findings. The class with the highest response rate was only 49%. In social network analysis studies, response rate is crucial because capturing an accurate social picture of a group and its internal social ties requires reporting from a high percentage of group members. The higher the response rate, the more complete the social picture of the group. A response rate of 49% yields a social picture that is 49% complete. However, it is extremely difficult to achieve much higher levels of response rate, especially survey studies. Survey studies in education are no exception and it seems even more challenging in studies of online courses (Sheehan, 2001).

There are many reasons for the low response rates in many studies. The main reasons suggested by the literature are the number of notifications given, and the length

of the surveys. The survey that was used in this dissertation had a total of 65 questions excluding the social networks questions. The social network questions may also contribute to the impression of a long survey because it gives a list of all other class members so that the participants can check off on the list the people they talk to in class. Therefore, future studies may wish to shorten the survey instrument to achieve better results.

A second limitation has to do with the constructs and instruments. The items in the instruments were created based on definitions, descriptions and explanations in the literature rather than past questions that have had high reliability. Although the constructs in the instrument had reasonably high reliability, the difference in the questions may make it hard to compare across studies.

Third, the study did not connect the social integration to academic achievement and attrition, the ultimate goals of learning. The overarching objective of this dissertation was to explore different factors in the online learning environment that would improve student learning. Even though the study provided literature on the theoretical associations between social interactions, social integration, and academic achievement, it did not analyze the correlation between these constructs. Furthermore, the nature of student learning was also not analyzed. This study cannot make any claims about how the quality of student learning has been affected by social integration or social interactions. Future studies may address this issue as it is important to learn not only of the consequences of social interactions but also how the process affects the nature and quality of learning.

Lastly, the study did not collect data on the type and nature of class activities specific to each of the classes. The organized class activities might have offered more perspective on how integrated the students were, and on the role of the instructor in influencing social interaction patterns. This dissertation addressed the role of the instructor in an indirect manner through asking students for their perception of the availability of instructors for social activities. One might also be able to argue for, and speculate on different types of activities that might help promote social integration based on the results of the study. However, this study did not systematically study this aspect to confirm some of the suggested activities provided in the discussion section. Future studies may address these issues.

Appendix A
Instrument A:

Section 1:

1. Using the following classlist, identify the people you have interacted with, and indicate how much you have interacted with each person. Leave blank if you have never interacted with them.

Tan, Huey

- ☐ 1-5 times
- ☐ 6-10 times
- ☐ 10-20 times
- ☐ more than 20 times

2. Identify the people <u>you know best</u> in this class. For each of these names, indicate how you interact with that person.

Tan, Huey

- ☐ Face-to-face
- ☐ Electronically
- ☐ Other

3. How much time do you spend on different types of technologies and activities EACH WEEK ? Check the appropriate box.

1. Web authoring

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours

- ☐ 5 hours to 10 hours
- ☐ 10 hours to 20 hours
- ☐ more than 20

2. Image editing

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours
- ☐ 5 hours to 10 hours
- ☐ 10 hours to 20 hours
- ☐ more than 20

3. Chat (instant messengers, etc.)

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours
- ☐ 5 hours to 10 hours
- ☐ 10 hours to 20 hours
- ☐ more than 20

4. Typing

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours
- ☐ 5 hours to 10 hours
- ☐ 10 hours to 20 hours
- ☐ more than 20

5. Word Processing

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours
- ☐ 5 hours to 10 hours
- ☐ 10 hours to 20 hours
- ☐ more than 20

6. Powerpoint

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours
- ☐ 5 hours to 10 hours
- ☐ 10 hours to 20 hours
- ☐ more than 20

7. Email

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours
- ☐ 5 hours to 10 hours
- ☐ 10 hours to 20 hours
- ☐ more than 20

8. Search for information on the web

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour

- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours
- ☐ 5 hours to 10 hours
- ☐ 10 hours to 20 hours
- ☐ more than 20

9. Using a Database or Spreadsheet

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours
- ☐ 5 hours to 10 hours
- ☐ 10 hours to 20 hours
- ☐ more than 20

10. Programming

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours
- ☐ 5 hours to 10 hours
- ☐ 10 hours to 20 hours
- ☐ more than 20

11. Phone

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours
- ☐ 5 hours to 10 hours

- ☐ 10 hours to 20 hours
- ☐ more than 20

12. Video-Conferencing

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours
- ☐ 5 hours to 10 hours
- ☐ 10 hours to 20 hours
- ☐ more than 20

13. Class readings and assignments

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours
- ☐ 5 hours to 10 hours
- ☐ 10 hours to 20 hours
- ☐ more than 20

14. Working and/or communicating with classmates

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours
- ☐ 5 hours to 10 hours
- ☐ 10 hours to 20 hours
- ☐ more than 20

15. Working and or communicating with instructor and/or staff

- ☐ No time
- ☐ less than 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 hour to 2 hours
- ☐ 2 hours to 5 hours
- ☐ 5 hours to 10 hours
- ☐ 10 hours to 20 hours
- ☐ more than 20

4. Rate your skill/expertise of the following. Check the appropriate box.

1. Web Authoring

Don't know anything	Can do it with help	Can do it with a little help	Can do it without any help
☐	☐	☐	☐

2. Chat (instant messengers, etc.)

Don't know anything	Can do it with help	Can do it with a little help	Can do it without any help
☐	☐	☐	☐

3. Typing

Don't know anything	Can do it with help	Can do it with a little help	Can do it without any help
☐	☐	☐	☐

4. Word Processing

Don't know anything	Can do it with help	Can do it with a little help	Can do it without any help
☐	☐	☐	☐

6. Email

Don't know anything	Can do it with help	Can do it with a little help	Can do it without any help
☐	☐	☐	☐

7. Search for information on the web

Don't know anything	Can do it with help	Can do it with a little help	Can do it without any help
☐	☐	☐	☐

8. Video-conferencing

Don't know anything	Can do it with help	Can do it with a little help	Can do it without any help
☐	☐	☐	☐

Section 2: Please indicate your responses to each of these statements.

1. I am very skilled with computers.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

2. Having friendly relationships in class motivates me to work harder.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

3. I am confident of the subject matter in this class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

4. My goal is to achieve an "A" for this class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

5. I am upbeat and usually have a positive attitude.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

6. I usually like/get along with new people.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

7. I make an effort to be courteous.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

8. I am comfortable communicating my feelings and ideas verbally.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

9. I'm successful in hobbies and activities that involve group interaction.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

10. I enjoy listening to people.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

11. The instructor and/or staff for this class has well-prepared the learning activities.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

12. The instructor and/or staff for this class are concerned with my learning and intellectual development.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

13. The instructor and/or staff for this class are available and willing to help me with the course.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

14. I am happy with my intellectual development in this class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

15. The instructor and/or staff are available for informal social interaction outside of class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

16. I feel comfortable interacting with people in this class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

17. I am comfortable approaching my classmates for help with my work.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

18. I feel that I am a part of this class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable

☐	☐	☐	☐	☐

19. I know where to get counseling if I need it.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

20. I belong to the dominant group in this class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

21. I have friends in this class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

22. I enjoy participating in this class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

23. I enjoy the subject matter of this class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

24. I am influenced by the other students in my class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

25. I am influenced by the instructor and/or staff in my class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

26. I tend to ignore other students in class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable

☐	☐	☐	☐	☐

27. I am aware of the other students in my class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

28. My classmates are able to communicate their thoughts clearly.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

29. The instructor and/or staff are able to communicate his/her thoughts clearly.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

30. I often respond to my instructor and/or staff.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

31. I often respond to my classmates.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

32. My participation in class discussions and other in-class group activities is valued by other members in the class.

Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
☐	☐	☐	☐	☐

33. I engage in group work for class assignments/projects.

Rarely	Occasionally	Quite Often	Very Often	Not Applicable
☐	☐	☐	☐	☐

34. I interact with my classmates outside of class.

Rarely	Occasionally	Quite Often	Very Often	Not Applicable

☐	☐	☐	☐	☐

35. I participate in extra curricular activities.

Rarely	Occasionally	Quite Often	Very Often	Not Applicable
☐	☐	☐	☐	☐

36. I have personal interactions with my instructor and/or staff.

Rarely	Occasionally	Quite Often	Very Often	Not Applicable
☐	☐	☐	☐	☐

Section 3: Please select your responses, and fill in the blanks where appropriate.

1. Sex:

☐ Male
☐ Female

2. Ethnicity (Please check all that apply):

☐ Caucasian
☐ African-American
☐ Asian / Pacific islander
☐ Hispanic / Latino
☐ Native American
☐ Other (please specify):

3. Highest educational level achieved:

☐ High School
☐ Associate Degree
☐ 4-year degree
☐ Masters

- ☐ PhD
- ☐ Other (please specify): _____

4. My overall grade-point average (GPA) is:

- ☐ < 1.5
- ☐ 1.5 - 1.9
- ☐ 2.0 - 2.4
- ☐ 2.5 - 2.9
- ☐ 3.0 - 3.4
- ☐ 3.5 - 4.0

5. How many online courses have you taken prior to this one?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 or more

6. Highest educational level my mother has achieved:

- ☐ Elementary
- ☐ Middle
- ☐ High School
- ☐ Associate Degree
- ☐ 4-year Degree
- ☐ Masters
- ☐ PhD
- ☐ Other (Please specify): _____

Submit

Appendix B

Class	gender	education	gpa	pastOnline	motherEd
1	0.9697	0.5			
2	fixed par	0.4227	0.6365	0.3427	0.6678
3	0.8874	0.7725	0.8451	0.5337	0.881
4	0.34	0.48	0.42	0.51	0.53
5	0.61	0.79	0.65	0.63	0.8
6	0.29	0.053	0.03	0.054	0.039

Class	skilled	relationships	confident	Agoal	upbeat
1				0.2831	0.7806
2	na	na	0.3539	0.3369	na
3	0.8566	0.6708	0.7575	0.8165	0.7879
4	0.42	0.54	0.49	0.46	0.51
5	0.69	0.83	0.7	0.65	0.77
6	0.052	0.05	0.057	0.065	0.049

Class	getAlong	courteous	feelings	successGroup	listening
1					
2	0.3684	0.3108			
3	0.7879	0.8177	0.7835	0.7443	0.7471
4	0.01	0.5	0.56	0.54	0.51
5	0.4	0.79	0.83	0.82	0.82
6	0.6	0.03	0.036	0.047	0.11

Class	instPrepared	instConcerned	instAvailable	happy	instSocial
1					
2			0.1357		
3	0.9485	0.8616	0.9317	0.842	0.842
4	0.52	0.46	0.51	0.49	0.46
5	0.78	0.76	0.76	0.73	0.71
6	0.039	0.06	0.05	0.054	0.043

Class	cmInteracting	cmHelp	Part	counseling	dominant
1		0.2964			
2	0.2938	0.2303	0.6549	0.414	
3	0.7903	0.7094	0.7511	0.8717	0.9597
4	0.15	0.47	0.5	0.52	0.52
5	0.7	0.7	0.66	0.7	0.62
6	0.79	0.08	0.12	0.09	0.13

Class	friends	enjoyClass	enjoySubject	influencedByCm	influencedByInst
1					
2	0.219		0.265	0.3669	0.2456
3	0.6031	0.8063	0.8747	0.7396	0.8811

4	0.54	0.51	0.5	0.51	0.44
5	0.68	0.62	0.8	0.77	0.81
6	0.09	0.14	0.14	0.15	0.13

Class	ignoreCm	awareCm	cmCommunicate	instCommunicate	respondInst
1	0.9532				
2	0.4227		0.5519		0.274
3	0.9458	0.7462	0.7948	0.8021	0.8994
4	0.85	0.48	0.48	0.44	0.48
5	0.66	0.74	0.78	0.82	0.84
6	0.36	0.11	0.11	0.19	0.15

Class	respondCm	engage	extraCurricular	personalInst	timeWeb
1					
2	0.414	0.3548		0.1522	0.6905
3	0.7193	0.6241	0.9581	0.8014	0.7985
4	0.55	na		na	0.59
5	0.74	0.7	0.77	0.79	0.78
6	0.08	0.13	0.1	0.1	0.07

Class	timeImage	timeChat	timeTyping	timeWp	timePP
1	0.8823	0.5906	0.1473		0.9198
2	0.7398	0.2515	0.4389		0.141
3	0.83	0.8464	0.7396	0.7607	0.9616
4	0.77	0.69	0.46	0.54	0.35
5	0.54	0.7	0.8	0.79	0.82
6	0.36	0.1	0.1	0.18	0.15

Class	timeEmail	timeSearch	timeDB	timeProg	timePhone
1	0.3187	0.9066			
2		0.4918	0.3551	0.4549	0.3728
3	0.8631	0.4606	0.818	0.859	0.7006
4	0.49	0.5	0.52	0.36	na
5	0.65	0.7	0.8	0.49	0.85
6	0.08	0.13	0.13	0.1	0.1

Class	skillWeb	skillChat	skillType	skillWP	skillEmail
1					
2	0.5241		0.4232	0.3642	0.5771
3	0.8923	0.8177	0.9194	0.8636	0.8621
4	0.04	0.5	0.47	0.46	0.48
5	0.72	0.76	0.76	0.74	0.79
6	0.07	0.67	0.14	0.14	0.13

Class	skillSearch	skillVC	timeVC	consent	participation
1		0.0047			
2					0.414
3	0.8621	0.7252	0.586	0.8621	0.9449
4	0.46	0.49	0.46	0.41	

5	0.73	0.7	0.03	0.8	
6	0.22	0.11	0.09	0.09	0.1

Class	caucasian	OutsideInteractNew	timeCA	timeCM	timeInst	race
1					0.1874	
2		0.2964	0.3555		0.3267	
3	0.9115	0.8577	0.8094	0.6027	0.7944	
						0.4404,
						0.5884,
						0.2998
4		0.74	0.56	na	0.48	
						0.8646,
						0.7679,
						0.8659
5	0.57	0.39	0.57	0.87	0.52	
						0.1061
						0.1719
						0.5666
						0.8294
6	0.13	0.85	0.09	0.07	0.07	0.7430

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