CHAPTER ONE

A social network is a web of one's relations with others. "Network analysts maintain that the structure of the social environment can be shown to affect people's access to the sort of ongoing feedback and guidance needed in everyday life" (Gottlieb, 1981, p. 204). The patterns of relationships either facilitate or restrict opportunities for the formation of new and maintenance of existing social ties (House, Umberson, & Landis, 1988; Stanton-Salazar & Dornbusch, 1995), effect behavior (Berkowitz, 1982), and affect access to resources, support, and information (Wellman & Frank, 2000).

The social networks of international students have been characterized as insular, dense, and homogeneous (Bochner, McLeod, & Lin, 1977; Heikinheimo & Shute, 1986; Tanaka, Takai, Kohyama, Fujihara, & Minami, 1994). The ramifications of such networks include reinforcement of norms and behaviors and strong support in certain situations, but limited access to unique resources and information. International students with less dense, less homogeneous networks have benefited through adjustment, adaptation, and satisfaction in their host environment.

This research is concerned with the support networks of international students. I focus on a thread of international students' entire social support network. That thread includes support critical to the academic progression of students as it relates to understanding and meeting the rules, regulations, and deadlines of the higher education system in the host environ.

The goals of this research are twofold. The first is to understand the support networks of Chinese and Indian graduate students including who provides support, satisfaction with the network, and effect of the network on progression toward academic goals. The second is to test theories and study variables within the social network perspective at both the relational and

structural levels. The relational and structural attributes of respondent's social network will indicate how need for this support is being met.

This chapter begins with a brief discussion of social networks and is followed by a description of the international student population, their social networks, the need for and challenges of building social networks, and a discussion of the type of support addressed by this study. The second major section of this chapter is devoted to a discussion of the social network perspective, social network analysis, and a list of definitions relevant to this study. Goals of the study, methods, the population, assumptions of the research, research questions, significance of the study, and limitations are all presented in the third section. A final section discusses the organization of the subsequent chapters in this dissertation.

Personal Social Networks

Social networks are webs of relations. They include a set of actors and the relations that bind them. Interactions, transactions, support, communication, and all aspects of daily life (Fischer, 1982) take place through our social networks. A personal social network (personal network or ego-centered network) is a web of social relations with ego at the center. The broadest definition of one's personal network would include all those with whom a conversation can take place. Types of relations (e.g., relatives, neighbors, classmates) or types of support (e.g., medical, emotional, advice) are ways to identify a personal social network.

Studies of personal networks examine how an individual's ties enable resource flow. The ties between ego and actors, and between actors and other actors, are studied. Network analysts model relationships to describe the structure of a group. Social network theorists maintain that behavior is affected more by the kinds of ties and networks in which actors are involved than by the norms and attributes they possess.

International Students

International students comprise a significant proportion of the student population, worldwide. In 2001, there were just under half a million international students studying in the U.S. (Altbach, 2002; Institute of International Education, 2001; McMurtrie, 2001). They represented nearly 3% of undergraduate enrollments and 12% of graduate enrollments, or just under 4% of total enrollments in U.S. colleges and universities (Altbach, 2002; Institute of International Education, 2001; McMurtrie, 2001). The international graduate student population in the U.S. constituted 44% of the overall international student population (Altbach, 2002). Students from China and India comprise the greatest percentage of international students in the U.S., together contributing over 20% of U.S. enrollments, or nearly 60,000 students from each country (Institute of International Education, 2001; McMurtrie, 2001).

International students are their nation's best and brightest. For several reasons, they are an especially significant asset to U.S. higher education at the graduate level: (a) they support and advance research efforts; (b) they teach; and, (c) more so than U.S. graduate students, they require little to no financial assistance from the university.

Social Networks of International Students

In coming to the U.S., international students typically break from their social networks of family, friends, confidants, neighbors, and co-workers leaving behind their traditional support structures (Tanaka et al., 1994). They arrive with significant needs, among them: (a) tutoring on language skills; (b) basic sustenance assistance such as housing, food, and money; (c) friendship; and (d) information (Church, 1982) and are forced to create social networks and social support systems anew (Tanaka, Takai, Kohyama, Fujihara, & Minami, 1997). Arriving with minimal contacts in their host country, many international students seek out contacts of their own ethnic

or national group to begin building a social network and social support structure (Heikinheimo et al., 1986; Zimmermann, 1995). Indian and Asian students especially, among others, form enclaves of fellow nationals in the host country to help with housing, friendship and organizational connections as well as resources for discussing and interpreting their new environment (Church, 1982).

Most international students' networks tend to be predominately made up of similar others with same cultural backgrounds and of other non-host student sojourners. Tanaka et al., (1994), found international students have friends and acquaintances at varying levels of intimacy with whom they interact for a variety of purposes. Despite the benefits of host members in the social network of international students, the bi-cultural network (consisting of international student and host national) is the least prominent of international students networks (Bochner et al., 1977; Furnham & Bochner, 1982; Klineberg, 1982; Klineberg & Hull, 1979; Ward, Bochner, & Furnham, 2001).

Building Social Networks

To ensure adequate support of all kinds, international students must devote energies to creating and maintaining sufficient relationships and social networks that satisfy their needs (Stokes, 1983; Walker, Wasserman, & Wellman, 1994). Social networks have been critical in providing the social support needed to help counter international students' most pressing needs: tutoring on language skills; sharing housing, food, and transportation costs; financial assistance; friendship; and information. Those international students who had established a social network and a social support environment to facilitate social contact and social assistance were more likely to be satisfied with their experience (Klineberg et al., 1979; Sam, 2001; Westwood & Barker, 1990); to be better adapted or exhibit social well-being (Surdam & Collins, 1984; Tanaka

et al., 1997; Westwood et al., 1990); and as a result of adjustment and adaptation, to achieve their goals (Hayes & Lin, 1994; Heikinheimo et al., 1986; Jou & Fakada, 1994; Zimmermann, 1995).

Hosts have been the source of a variety of types of support including tutoring, friendship, and information. Several studies (e.g., Heikinheimo et al., 1986; Jou et al., 1994; Jou & Fakada, 1995; Westwood et al., 1990; Zimmermann, 1995) have linked their involvement in the international students' social networks to successful adjustment and adaptation, and to sojourn satisfaction. Social networks that include host students have had a positive and significant impact on international students in a number of areas: (a) improved communication competency (Ward et al., 2001; Surdam et al., 1984; Zimmermann, 1995); (b) language and academic support (Bochner et al., 1977; Ward et al., 2001); and, (c) in providing instrumental support towards academic achievement (Klineberg et al., 1979; Tanaka et al, 1994; Westwood et al., 1990). Additionally, the absence of hosts has been associated with dissatisfaction with the sojourn (Maundeni, 2001).

Challenges of Building Social Networks

Network theory stresses the benefits of forming relationships with those who have the capacity to access or deliver resources and opportunities (Stanton-Salazar et al., 1995). For international students, in particular, "…generally, the individuals who control the desired academic resources are the host nationals" (Bochner et al., 1977, p. 279).

"In general, we each construct our own networks. The initial relations are given us -- parents, close kin -- and often other relations are imposed upon us -- workmates, in-laws, and so on. Over time, we decide whose company to pursue, whom to ignore or leave as casual acquaintances, whom to neglect or break away from" (Fischer, 1982, p. 4).

Building social networks in the host environ is difficult for many international students (Heikinheimo et al., 1986; Maundeni, 2001). Language, negotiating day-to-day social activities, isolation, and racial and ethnic discrimination are among the significant socio-cultural barriers to social network formation for international students with consequences in both academic and non-academic settings (Bochner et al, 1977; Church, 1982; Furnham et al., 1982; Maundeni, 2001; Sam, 2001). For these reasons and others, when people begin to build networks they tend to do so with similar others (Feld, 1981, 1982, 1984; Fischer, 1982; McPherson, Smith-Lovin, & Cook, 2001). Newly arrived international students rely on informal channels of information within their own national group and over time these relations become strong, leading to networks of similar others (Heikinheimo et al., 1986).

International students characteristically have homogeneous and dense social networks composed mostly of conationals (Bochner et al., 1977; Heikinheimo et al., 1986; Tanaka et al., 1994). The insular nature of dense, homogeneous networks reinforces isolation, limits opportunities for connections with dissimilar others, limits access to resources and new sources of information, and limits opportunities to learn and use the host language. The insularity also "…limits people's social worlds in a way that has powerful implications for the information they receive, the attitudes they form and the interactions they experience" (McPherson et al, 2001, p. 415).

Support

This research attempts to fill a void in the social network research on international students; that is, the role a specific type of support plays in facilitating academic progression. It focuses on a thread of the student's entire social support network -- one that includes guidance or assistance related to understanding and meeting the rules, regulations, and deadlines associated

with progress through the host university system and community environment. This research focused on the type of support network invoked when students require assistance working their way through the higher education system including the processes associated with university requirements, graduate school requirements, and college and department requirements to facilitate academic progression. It also includes federal requirements and community rules and regulations. Specifically, members of this network might be called on for assistance with finding university resources available to students, identifying appropriate course requirements, selecting a course or an advisor, learning how to apply for graduation, or completing paperwork required for the graduate school. Network members may also provide information and guidance related to federal and state regulations, guidelines such as visa requirements or Immigration and Naturalization Service regulations, and local rules and regulations such as those associated with obtaining a driver's license.

Given the insular nature of the social networks of international graduate students, I am interested in investigating how and from whom the Chinese and Indian graduate students obtain assistance making their way through the university system and complying with university, community, and state and federal rules and regulations.

In the section that follows, I provide a brief description of the social network perspective and the study of social networks. The final section contains a discussion of the research focus and a series of definitions relevant to this study.

Social Network Analysis

Social Network Perspective

A distinguishing difference between the social network perspective and standard social and behavioral science research and methods is its view of social units. The social network

perspective views social units as a byproduct of a structural or relational process. Social and behavioral sciences, on the other hand, begin research with the social unit, sampling, and studying.

Theories, models, and applications of the social network perspective are defined in terms of relational concepts or processes. Relations, defined by ties among units, are a fundamental component of network theories. Four tenets characterize the social network perspective: (a) actors and their actions are interdependent, (b) relational links or ties between actors are conduits for the transfer of resources, (c) the structural environment of a social network either constrains or enables individual action, and, (d) network structure is perceived as lasting patterns of relations among actors (Wasserman & Faust, 1999; Galaskiewicz & Wasserman, 1994).

Analyzing Social Networks

The study of social networks involves analyzing the connections and relationships between and among individuals. The field of study is called social network analysis. Networks can be studied at any level – group, organization, community, etc. Personal (egocentric) network studies focus on the social relations of ego, the individuals connected to ego and to one another by specific types of relations, and the structure created by these relationships. Egocentric network research has been limited to examining parts of ego's network created by particular types of ties (Ruan, 1998).

The most basic feature of network analysis is the use of relational and structural information to study or test theories at both the relational level and at the structural level. Relationship-level theories are derived from the study of variables such as frequency of interaction and strength of relationship. Network structure is studied and understood in terms of variables such as network homogeneity, density, solidarity, and size. All are indicators of

opportunities and barriers to resources and access to unique information. For example, larger size and heterogeneity infer greater access to unique information; frequent interaction and strength of relationship infer strong support; and, network density (which measures the extent to which network members know one another) and network solidarity (which measures the closeness of network members) indicate convenient and strong support mechanisms (Hurlbert, Haines, & Beggs, 2000). The implication is that information traveling in dense, homogeneous networks is redundant; thus, a network with these attributes would be less successful in providing information-rich support than would a more heterogeneous network. However, a dense, homogeneous network would be advantageous and optimal in dealing with a crisis.

Definitions

This research is framed in the network perspective. Concepts of network analysis, especially the focus on relations and patterns of relations, differ from those of traditional data analysis. Terms associated with network analysis and the network perspective follow.

Actor is a discrete social entity in a network. In this research, the phrase *network member* is often used in place of actor.

Density is a measure of the connectedness of network members. It is a ratio of the number of existing ties relative to the number of all possible ties.

Ego is the focal point of a personal social network. Ego is the respondent in a personal social network or egocentric network study.

Egocentric network is a personal network with ego at the center; ego's personal network.

Homogeneity is a measure of the similarity of actors in a network.

Name generator is the survey question that elicits the names of network members. A common name generator is "who are your friends?"

Name interpreters are the questions that generate attributes of the network members identified in the name generator.

Network analysis is a tool for the study of social structure and relational processes. The focus is on actors and their ties at all levels.

Network member is the term used throughout this research to reference the individuals or actors identified by ego or respondent.

Relation is a collection of a specific type of tie such as friendship, co-worker, etc. Often several different types of relations are measured on a set of network members.

Relational tie is the link between and among actors. The variety of types of relational ties is extensive (e.g., friendship, transfer of resources, membership in an organization, behavioral interactions, formal relations).

Relational level analysis involves studies at the actor and tie level. Variables distinct to this level of analysis include frequency of interaction and strength of relationship.

Social network is a finite set of actors and their relations.

Social network perspective is the mindset of the application and study of social networks.

Social network structure refers to the presence of regular patterns in a network.

Social support is a generic term for all types of support.

Solidarity is a measure of closeness between and among network members.

Structural level analysis involves studying the aggregate of network relationships. Variables distinct to this level of analysis include size, density, solidarity, and homogeneity.

Structural variables refer to quantities that measure the typology of the network (size, for example). Structural analysts study social structure and its consequences analyzing relations that exist as a result of an exchange.

Tie is a link between two actors. The tie is a property of the pair of actors. It represents flow of resources, friendships, or relationships between network members and it is often measured in terms of strength.

The remainder of this chapter is devoted to a discussion of the study including goals and methods, the population, assumptions, the research questions, and significance and limitations of the study.

Goals of the Study

I strive to achieve two major goals in this study. One is to describe and explore the support networks of Chinese and Indian graduate students to understand their need for and acquisition of this specific type of support, who provides this support (i.e., the network members), attributes of the network members and their relationships with ego, network typology (e.g., size, homogeneity), satisfaction with the support network, and the effect of the support network on achieving academic goals. The second goal is to test whether theoretical claims of network structure (homogeneity and density) and network relations (tie strength) hold true for Chinese and Indian international graduate students. Network theorists claim homogeneity and density contribute to insular, information-redundant environments and that weak ties are needed for accessing unique information. These variables describe an aggregate of interactions in the personal network. This study will determine whether the networks are homogeneous and dense, and if so, whether they inhibit access to needed support and information.

Methods

The study is grounded in social network theory. The methods are based on a social network approach. Data in this study will be derived using a single name generator and a series of name interpreters. This research will result in one personal (egocentric) network for each

individual respondent. For purposes of this study, the network will be composed of ego and up to four network members.

Population

I will study the support networks of two groups of international graduate students (Chinese and Indian). These two populations were selected because of their significant numbers in U.S. higher education and worldwide.

Assumptions

The focus of this research is predicated on several findings that have been highlighted in the research literature. These include observations that international students must create their own social networks upon arriving at their new institutions, that they tend to begin that process through and with similar others, and that the membership of their social networks tends to be predominately conational. Research has shown that host member involvement in an international student's social network affords a wide variety of advantages. Moreover, Bochner and associates (1977) have found that international students recognize that hosts control resources and this recognition drives international students to build relations with hosts.

Little is known about social network structure related to facilitating international students' sojourns through the university system towards achieving academic goals. It is presumed that the support being studied here is a critical component of the academic sojourn; that is, international students need to actively seek answers to questions related to the university system as it affects progress toward academic goals. I have validated this assumption and further clarified the specific aspects of this type of support through focus group discussions with Chinese and Indian graduate students. Examples of this type of support include information

related to advisor choices, university employment, visa issues, graduate school paperwork, course requirements, and other aspects of university culture.

The results of this study will identify whether progress toward academic goals are affected by this type of support, whether the support networks meet student's needs, and whether network theories hold true in these circumstances. Specifically, the study was designed to explore the following research questions:

1. *What are the characteristics of university system support networks of Chinese and Indian graduate students? Who provides support? What are the attributes of the providers?*
2. *What are the structural attributes of the support networks? How does the structure of the network affect the provision of support?*
3. *What is the effect of network structure on academic goals? How does the support network influence the achievement of academic goals?*
4. *How are the networks of Chinese and Indian graduate students similar and how do they differ in terms of size, homogeneity, solidarity, and density? What are the implications for satisfaction and effectiveness? Do social network theories related to variables at the structural level (homogeneity, density, solidarity) and relational level (closeness) hold true for the support networks of the Chinese and Indian graduate student populations?*

Significance of the Study

A considerable amount of research on the international student population has highlighted factors affecting adjustment, satisfaction, and adaptation. Academic success has been linked to these factors. Missing from the research on international student's social networks is

instrumental action related to students' searches for and acquisition of support, resources, or information. This research fills that void by uncovering the sources, attributes, satisfaction, and effectiveness of support related to successfully make their way through the university system.

This research aids theory and practice. In theory, international students should establish new network members, via weak links, to access new sources of information in their new host environment. I will provide information about the extent to which this takes place and how the support network affects progress toward academic progression. Practically, the findings contribute to a broader understanding of the international student's networks and of the effect of support networks on academic progression.

Limitations

Because of their significant numbers in the U.S., Chinese and Indian students were the focus of this research. This study is bound by the type of social support being examined and by the population from which participants are sampled.

Organization of the Study

This study is reported in five chapters. Chapter One provides introductions to social networks, the international graduate student population, the need for and challenges of building social networks, the social network perspective, and the study of social networks. Goals of the study, significance, assumptions, and research questions are also included.

Chapter Two is a review of related literature. It provides additional information on the social network perspective and the conduct of research using social network methods, and it presents a framework on which this research is based. Further, related literature documenting the use, attributes, and effects of international student's social networks are reviewed.

Chapter Three describes the sample population, methodology, and evaluative procedures of the study. Chapter Four presents findings of the research and Chapter Five presents a discussion of the results and implications for further research and practice.

CHAPTER TWO

Review of the Literature

The widespread use of the social network approach across disciplinary boundaries is testimony to its utility in addressing a variety of research questions. Sociologists, economists, anthropologists, and organizational and communication theorists, among others, have conducted research using a social network approach. Sociologists have studied the social life of people's personal relations in neighborhoods and communities (Burt, 1985; Wellman, 1979), the personal networks of individuals (McCarty, 2002; Schweizer, Schnegg, & Berzborn, 1998), the effects and attributes of friendship networks (Bochner, Hutnik, & Furnham, 1985; Fischer, Jackson, Stueve, Gerson, & Jones, 1977; Fischer, 1982; Wellman, 1979), job seeking behavior (Granovetter, 1973), and the effects of social networks on social support (Fischer, 1982; Schweizer et al., 1998). The effects of social network attributes on power and influence (Friedkin 1990, 1993, 1998) and on organizational proximity (Ibarra & Andrews, 1993) have also been studied by sociologists and organizational theorists.

By the mid 1980s social network research had become a fundamental mode of researching people's behaviors as evidenced by the inclusion of ego network questions in the 1985 U.S. General Social Survey. Respondents were asked to name those whom, within the previous six months, they had discussed matters important to them, and then answer questions related to attributes and strength of those relationships.

The study of social support is a predominant use of social network analysis. Researchers interested in international student behavior have studied social networks to understand social support of foreign students (Jou et al., 1994; Tanaka et al., 1997); and satisfaction with social support (Stokes, 1983), as well as foreign student adjustment (Jou et al., 1994; Maundeni, 2001;

Surdam et al., 1984; Tanaka et al., 1997) and adaptation (Heikinheimo et al., 1986; Lewthwaite, 1996; Surdam et al., 1984).

What is not addressed in studies of international student's social networks is instrumental action related to students' searches for and acquisition of support, resources, or information. My research builds on previous social network and international graduate student research by focusing on a thread of their support networks -- one that facilitates assistance and guidance related to understanding and meeting the rules and regulations of the host higher education system. International graduate students from China and India are being studied because these two countries provide the largest number of students to the U.S.

In this chapter I define and discuss social networks, social network analysis, social support, the current international student population, and present a review of relevant literature. The discussions take place in four separate sections. The first includes the definition of social networks and then offers a discussion of personal (egocentric) networks. The second section provides a review of social network analysis (the means by which social networks are studied), and the parameters of study at the relation level and at the network structure level. Social support research is briefly presented in the third section. The generic nature of social support and the value social networks have contributed to the study of social support will be highlighted. The fourth and final section brings the international student back into focus with greater discussion on their presence in higher education, results of previous studies, and a discussion of their social networks.

Social Networks

Definition

"…daily life proceeds through personal ties…" (Fischer, 1982, p. 3). As noted in Chapter One, one's ties and relations with others constitute a social network. Access to resources, information, support, and friendship are enabled through one's social network. The crux of the social network concept is that constraints and opportunities on individual action are bound by the structure of one's social network. A social network perspective enables the study of the network members and the relationships among them.

Four tenets characterize the social network perspective: (a) actors and their actions are interdependent, (b) relational links or ties between actors are conduits for the transfer of resources, (c) the structural environment of a social network either constrains or enables individual action, and (d) network structure is perceived as lasting patterns of relations among actors (Wasserman et al., 1999; Galaskiewicz et al., 1994).

Personal Social Networks

Social network studies may be conducted for all ties linking a closed population (complete network) or for a set of ties linked to ego (Marsden, 1990). A person's entire social network would include all friends and all acquaintances and include all those he or she knows well enough to engage in conversation. Research (McCarty, Bernard, Killworth, Shelley, and Johnsen, 1997) has found 250 to 5000 individuals in people's networks.

Most studies of personal social networks, however, focus on only a portion of one's entire social network such as studies of friendship networks or networks of emotional support. Personal social networks are identified by their relational content – either type of relationship or

purpose of relationship. Relational content of friendship or relatives, for example, references personal networks of the same. Social support is a prevalent relational content.

The study of one's social network involves analysis both at the relational level and at the structural level. Relational level analysis involves studies of the relations between and among ego and other network members. The structure of the personal social network characterizes an aggregate of relationships. Structural level analysis involves studying the patterns of relationships among network members.

A personal network describes ego's relations with others in terms of the support received, frequency of contact, strength of relationship, and attributes of network member and of relationship. Three parameters (the ego, the network members, and the tie or the relationship) are examined in the study of a social network. Social network analysis, relationship level analysis, and structural analysis are presented in the next section.

Social Network Analysis

Social network analysis is commonly called structural analysis (Berkowitz, 1982), as it used to study highly organized, interrelated, and persistent or patterned forms of social activity. It "… is an approach to theorizing about, representing, and analyzing social processes which emphasizes their systemic character" (Berkowitz, 1982, p. vii). Social network analysis involves creating models of complex social phenomena which are conceptualized, studied, and explained as stable patterns of long-term relations among actors (Berkowitz, 1982; Fischer, et al., 1977; Galaskiewicz et al., 1994; Wasserman et al., 1999). Concurrently, both network member and the relationship at all levels of abstraction can be studied (Wasserman et al., 1999).

The premise of social network theory is that individual behavior is a function of one's relationships with others. Social network analysts are interested in what creates and what sustains

social relationships. They examine patterns of relationships that connect members of social systems, study the structure created of the interactions (Garton, Haythornwaite, & Wellman, 1997), interpret action as a result of the social network (Fischer et al., 1977), and determine how resources are channeled through the structure (Berkowitz, 1982; Burt et al., 1983; Fischer et al., 1977; Galaskiewicz et al., 1994; Garton et al., 1997; Tindall & Wellman, 2001; Wasserman & Faust, 1999). Relationships may be with friends, relatives, neighbors, or members of a club or organization, or they may represent other transactions.

A significant feature in the network perspective as a research method involves the manner in which system boundaries are determined. Most social network analysts do not treat officially defined groups as social boundaries; rather they trace the social relationships of the persons under study. Only if the relationships cross officially defined boundaries, does the formal boundary become an important analytic variable rather than a predefined analytic constraint.

One of the significant ways in which boundaries are defined and networks identified is through the use of name generators.

Name Generator

Most networks, including personal ego-centered networks, are derived through the use of name generators. Name generators pose one or more questions about ego's contacts in certain role relationships (e.g., school, neighborhood), content areas (e.g., educational support, health support), or intimacy (e.g., confidant, acquaintance). These questions generate a list of contacts or network members. From these network members, relationships between ego and network members and among network members are identified. Further questions elicit attributes of network members. One complication in the recall aspects of name generators is that the data tend

to reflect stronger ties (Campbell & Lee, 1991), and oftentimes, it is both the weak and the strong ties that are of interest.

"There is considerable disagreement about the best personal network name generator to employ when a single question is practical.…major differences in name-generator wording may in some situations have little or no effect on reported egocentric networks" (Straits, 2000, p. 123). The name generator posed in the 1985 General Social Survey has become one of the most common name generator questions referenced: "From time to time most people discuss important matters with other people…who are the four or five people with whom you discussed matters important to you?…" (Burt, 1997).

Name generators can also be limiting by specifying a timeframe within which interaction takes place or by seeking only those who perform a specific role, such as persons with whom you discuss important matters (Campbell et al., 1991). An exchange name generator is a variation of a name generator (Ruan, 1998). Von der Poel (1993) and McCallister and Fischer (1978) advocated the use of exchange related questions in generating personal social networks because they specifically identify sources of rewarding interactions and thus, those responsible for affecting behavior.

Once the names of the network members are derived, questions are answered about the network members to gain insight into their attributes, patterns of relationships and network structure.

Name Interpreters

Attributes of the network members are generated from name interpreters. There are three types of name interpreters: (a) reports on attributes of network members, (b) reports on

properties of tie between respondent and network member, and (c) reports on intensity of tie between pairs of network members. All three types will be used concurrently in this study.

Relational-Level Analysis

Relational concepts are used to quantify the interactions and make assumptions about the network members, their relations, and the resulting structure of the network (Wasserman et al., 1999). Analysis at the relationship level provides insight into, among others, the type of relation, the transaction, the strength of the relationship, and frequency and involves the three parameters of a personal (egocentric) social network: ego, network member, and relationship.

Personal Social Network Attributes

Ego. Ego is the focal person of the personal social network. Ego will be the respondent in this research.

Network members. Network members (also referred to in the literature as actor, contact, and agent) are connected to ego through ties or links and provide support, friendship, or information. Network members can represent more than one type of relationship (a neighbor and a relative, for example). This is called multiplexity. Additionally, more than one type of resource (money and day care, for example) might flow between network members.

Relationships. The relationship is the unit of studying social network analysis. This feature distinguishes social network analysis from other social sciences which tend to study attributes of the group or individual under study. The terms *tie* and *relationship* are used interchangeably in network analysis. Each references the links between ego and network members and among network members. I will use both terms when discussing this link.

Ties and relationships are characterized in a number of important ways depending on the research question. Ties can represent any of a wide variety of relationship types including type of

relationship (e.g., friend), type of support (e.g., language), intensity or strength of relationship (e.g., acquaintance), homogeneity, membership in a group, propinquity, and frequency of contact. Ties are characterized as measures of duration, frequency, intimacy, and multiplexity (Campbell et al., 1991). Ties are also assumed to be positive and symmetric (Granovetter, 1973) and often imply reciprocity (Burt, 1980); however, Wellman's East Yorker study (Wellman, 1981) found support was not always symmetrically equivalent.

Tie Strength

Networks are sustained by the exchange of a single or of multiple resources through weak or strong ties. Tie strength is a linear phenomenon ranging from weak to strong and is a function of amount of time, emotional intensity, intimacy and reciprocal services which characterize the tie (Granovetter, 1973) and the functional or transactional nature of the relationship. The balance of weak to strong ties is especially important for access to resources. Research has attributed different functions to variations in tie strength (Granovetter, 1973, 1982; Nelson, 1989).

Strong ties tend to reflect similarity in attributes, background, and experience (Feld, 1982; Granovetter, 1973; Lin, 1982), and are used to build cohesion and solidarity (Granovetter, 1973, 1982); Those linked by strong ties are characterized by more frequent interaction, high level of intimacy, instrumental action, emotional and resource exchange (Granovetter, 1982; Marsden & Campbell, 1984; Walker et al., 1994).

Weak ties connect to dissimilar others. Those connected by weak ties engage in fewer, less intimate interactions, and typically share less information and support than those linked by strong ties. Weak ties, because they frequently bridge to a new set of network members, are often used to gather or diffuse unique information (Friedkin, 1978; Granovetter, 1973, 1982; Lin, 1982; Lin, Ensel & Vaughn, 1981) and sources of diverse resources (Granovetter, 1973, 1982;

Walker et al., 1994). Exposure to different others is what makes the study of weak ties significant (Burt, 1982; Granovetter, 1973). As a gateway to dissimilar others, weak ties are a key to social integration (Frank & Yasumoto, 1998; Granovetter, 1973, 1982).

In addition to studying the individual relationships, ego, and network members and their attributes, the structure of the personal social network itself is of significant importance in the study of social networks.

Network Structure

Network structure is the aggregate of relationships among network members. Structural analysis provides information on patterns of network relationships through variables such as network size (the number of individuals in one's network), homogeneity (the extent to which network members are similar), solidarity (a measure of closeness among network members), and density (the extent to which network members know all other network members). Size and density are among the most common measures of network structure (Burt, 1980). Together these measure the extent to which ego can rely on his or her network for social support. Each of these structural variables has implications on behavior. A discussion of each variable follows.

Network size. Network size refers to the number of individuals in a network. Network size has both positive and negative implications. A large network can provide lots of different kinds of support; however, large networks also require high energy to maintain (Stokes, 1983). Stokes (1983) found a curvilinear relationship between the number of confidents in one's social network and satisfaction -- satisfaction increases up to seven confidants after which it decreases. Networks with limited membership can present multiple disadvantages including limited knowledge of the environment and difficulty in forming alliances, which, in turn, are associated with limited mobility (Ibarra, 1993A).

Heterogeneity vs. homogeneity. Large networks have more heterogeneity in the social characteristics of network members than small networks. Large heterogeneous networks are good for obtaining new resources (Garton et al., 1997). Heterogeneity measures are the most direct indicators of diversity of persons within an individual's network. High diversity in a network implies interaction with dissimilar others. This is especially advantageous for actions such as seeking information (Granovetter, 1973; Lin et al., 1981; Marsden, 1987).

Homogeneity has been linked to strong social support for some types of support (emergency situations) and negatively linked to new sources of support and resources. Ties are more supportive when they operate in networks heavily composed of similar others (Tindall et al., 2001).

Density. Density indicates the extent to which each member of the network is connected with each other member of the network. It is computed as the proportion of ties present to ties possible. Network density is associated with strong social support in the form of resources and sociability and a sense of trust among members (Fischer, 1982; Kadushin, 2002). Dense networks contain less diverse others (Granovetter, 1973; Marsden, 1987) and often reflect the presence of pressures to conform. Because most members of a dense network know one another, the information conducted through it tends to be redundant.

Resources are typically easier to mobilize in dense networks because all members know one another; however, there are times when less dense networks are preferable. In his study of young widows and mature women turning to college, Hirsch (1981) found that while denser networks furnished greater quantities of support, students in these networks were less satisfied with the support they received and students in lower density support systems were more satisfied. Stokes (1983) found that "…very high density has a polarizing effect: For both

everyday and emergency support, the highest density group has both the largest percentage of respondents reporting no support and the largest percentage reporting maximum support; middle values of density are usually associated with middle values of support" (Stokes, 1983, p. 143).

Solidarity is a measure of the degree of emotional closeness between network members (McWilliams & Blumstein, 1991). To measure, close members are weighted more heavily than acquaintances or those connecting less frequently.

Multiplexity. Multiplexity is another measure of network structure. It refers to the number of different ways ego interacts with other members of his or her network. For example a neighbor might also be relative; and a co-worker might also be a friend. Multiplex ties are more intimate, voluntary, supportive, and durable. "Generally people with limited mobility, skills, and access to others should, by lack of alternatives be involved in multiple ways with the same person. The underlying assumption is that when people can develop specialized relations, they will" (Fischer, 1982, p. 142).

Previous research has contributed to the body of knowledge related to implications of the characteristics of network structure. A brief discussion follows.

Implications

A network structure of strong ties is likely to be dense and cohesive with members sharing redundant information. Network structures characterized by weak ties are thought to be information-rich by virtue of providing access to unique and non-redundant information.

A network created for efficacy is characterized by weak links and structural holes. Weak links and structural holes facilitate competition and access to unique resources and information. Structural holes are unique links to others and presumably, the resources to which they have

access. These links are not shared by other network members. Information traveling through this unique link is known in this network only to the single connector.

Dense networks are associated with redundancy; however they are important in times of need (e.g., illness, disaster). Heterogeneity in networks is associated with diversity and access to unique resources. Homogeneous networks are associated with strong social support systems.

Social support is a predominate use of social networks. Fischer (1982) attributed the popularity of the use of social networks in the study of social policy to their reliability in capturing and presenting social support systems.

Social Support

Social support is conducted through one's social network and occurs within the context of interpersonal relationships. It is a generic term for all types of support – financial, advice, medical, friendship, and more. People use their social networks to navigate daily life, seize opportunities, and reduce uncertainty (Wellman, et al. 1990). Social networks are a pipeline for the conduct of social support and "to the degree that one's social network provides one with technical and tangible assistance, emotional support, feelings of being cared about, self-esteem, etc., that network provides social support" (Stokes, 1983, p.142). The "…support literature by and large shows that support is rendered when the costs are low or the chance of direct reciprocity is very high … " (Kadushin, 2002, p. 86).

Social support is a principal way by which people get resources (Wellman et al., 1990). It "… consists of verbal and/or nonverbal information or advice, tangible aid, or action that is proffered by social intimates or inferred by their presence and has beneficial emotional or behavioral effects on the recipient" (Gottlieb, 1983, p. 28). In studies of social support, researchers have consistently distinguished among four categories of support: emotional,

material, companionship, and information (Wellman et al., 1990). Emotional support refers to giving or receiving advice and talking about personal problems. Instrumental support involves giving or receiving tangible support through goods or services. Friendship support refers to social activities, and information support refers to the giving and receiving of same.

Chinese and Indian international graduate students are the populations of study in this research. A brief description of these populations was provided in Chapter One. Below is a discussion of the social network studies of international students.

International Students

The United States is the leading destination of international students. It enrolled nearly half of the approximately 1.2 million international students worldwide in 2001 (Eland, 2001; Sam, 2001). Four countries are the source of nearly 40% of all international student enrollments into the United States in 2001. These countries are shown in Table 1.

Research on foreign students in the U.S. has tended to focus on the psychological and social impact of the sojourner (Marion, 1986). These studies have investigated adjustment, satisfaction, needs, goals, attitudes, values, and problems of foreign students. Social network studies of the international graduate student population have focused on the topics of previous studies as cited above: adjustment, adaptation, and satisfaction; however, the populations have varied, the host countries have varied, and the use of social network analysis has added insight into previous analyses.

Table 1

Top Four Sources of International Student Enrollments in the United States, 2001

Country of Origin	Number of Students	Percent of Total International Student Enrollments
China	59,939	11%
India	54,664	10%
Japan	46,497	8%
Korea	45,685	8%

Source: Institute of International Education, 2001.

International students require many different types of social support: tutoring on language skills; sharing housing, food, and transportation costs; financial assistance; information; and, friendship (Church, 1982; Zimmermann, 1995). The importance of a social network and its role in facilitating social support in the success of international students is well documented. Those who established a social support environment including a social network to facilitate social contact and social assistance were more likely to achieve their goals (Hayes et al., 1994; Jou et al., 1994; Heikinheimo et al., 1986; Zimmermann, 1995), to be satisfied with their sojourn (Westwood et al., 1990) and be better adapted or exhibit social well-being (Westwood et al., 1990; Surdam et al., 1984). Eland (2001) found advisor involvement in the social networks of graduate students critical to success.

Academic achievement is the international student's primary objective (Heikinheimo et al., 1986; Zimmermann, 1995) and forming social networks that facilitate that goal are critical. Success is a function of forming relationships with those who have the power or the capacity to access/deliver resources and opportunities (Stanton-Salazar et al., 1995). Referencing the needs of international students in particular, Bochner and colleagues found that "…(g)enerally, the individuals who control the desired academic resources are the host nationals" (Bochner et al., 1977, p. 279).

Functions of Social Networks

Bochner and associates (1977) identified three functions of the international graduate student's social networks: (a) a recreational function facilitated mainly by fellow international students, (b) a cultural function facilitated mainly by fellow nationals, and (c) an academic/professional training function met mainly by host members. Later, Tanaka and

associates (1994), studying expected social support of international graduate students in Japan, found the same three-function pattern in international graduate students' social networks (Tanaka et al., 1994). They found students relied on hosts for language, host culture information, and academic support; conationals for recreational activities and material/financial support; and, off-campus friends for emotional support.

Both studies also examined the composition of the social networks but from different perspectives. The study by Bochner and associates (1977) distinguished between friends and companions referring to those with whom the international students spent most of their time as companions. In comparing the composition of friends and companions in the international student's networks, Bochner et al. (1977) found, respectively, 43% and 46% conationals; 29% and 33% host culture; and 17% and 21% other culture. It makes sense that these numbers follow a similar pattern and are fairly similar. Most of the friends and those with whom international students spend most of their time are conationals, and approximately a third of relationships are with host members.

Tanaka and colleagues (1994) examined expected support and found international students expect academic support from advisor, lab partner, and tutor, and negligibly expect it from fellow student and from university staff. Presumably, both fellow students and university staff are more likely than not to be host nationals.

Review of Relevant Literature

Studies on the international student population are many and cover a wide variety of topics. Two significant reviews (Church, 1982; Marion, 1986) of the literature on foreign students were conducted in the 1980s. Marion (1986) categorized research conducted between the mid 1950s and the mid 1980s into five broad areas: (a) Admission and academic

performance; (b) interactions between American and foreign students; (c) psychological and social impact of the sojourn; (d) relationships between academic achievement, attitude and adjustment; and, (e) sojourners after returning home. Of findings related to academic success, Marion (1986) found studies consistently showed scores on English language tests strong predictors of academic success. Other research (Heikinheimo et al., 1986; Tomich, McWhirter, & King, 2000) confirms the effect of language on adjustment and adaptation. Overall, "these studies indicate that academic achievement of foreign students affects and is affected by their attitudes and adjustment, although a cause-and-effect relationship is not proven," concluded Marion (1986, p. 70).

The second significant literature review was conducted by Church (1982) who also reviewed over 30 years of research on international student adjustment focusing on problems and barriers experienced by international students. He categorized the findings into three areas: academic, personal, and sociocultural. His research consistently uncovered language, finances, homesickness, and adjusting to a new educational system and to new social norms the most frequently cited problems of the student sojourner. Racial discrimination was also a frequently cited problem for some students. He found international students generally satisfied with academic and professional aspects and somewhat less satisfied with nonacademic or social aspects, and he found older students and graduate students expressing greater academic and general satisfaction with professional goals and with the sojourn (Church, 1982).

The majority of research studies on international students attempt to address one or all of adjustment, adaptation, and satisfaction. Because of the significant overlap of adjustment, adaptation, and satisfaction in the literature, these are discussed together in the following section.

Adjustment

International students experience more adjustment problems than their native counterparts (Church, 1982; Kaczmarek, Matlock, Merta, Ames, & Ross, 1994; Klineberg et al., 1979; Maundeni, 2001). Adjustment problems are associated with differences in climate, food and living conditions (Church, 1982; Heikinheimo et al., 1986; Klineberg et al., 1979; Maundeni, 2001); a new sociocultural environment, a new language, and host country social values, behaviors and norms (Church, 1982; Klineberg et al., 1979); differences in academic culture and learning styles; (Church, 1982; Maundeni, 2001; Westwood et al., 1990); and, in some cases, discrimination in their host country (Church, 1982) and fear of political instability in their home countries (Maundeni, 2001; Stokes, 1983; Westwood et al., 1990).

Despite the difficult transition, international students possess a realistic self-perception of their ability to adjust to the college environ (Kaczmarek et al., 1994) and approximately 80% make reasonable adjustment to their new cultural and institutional demands (Church, 1982). Kaczmarek and colleagues (1994) suggested that those experiencing a more difficult transition may have had difficulty securing the appropriate type of assistance. Asian students, in particular, struggle most to adjust to the U.S. educational system (Abe, Talbot, & Geelhoed, 1998).

Heikinheimo and Shute (1986) analyzed international student interactions with host students to identify support service needs and developed a model of factors that influence (positively and negatively) foreign student's interactions with host students. They defined as inhibiting factors language, culture, personal characteristics, academic concentration, and perceived discrimination, all of which are consistent with Church's (1982) barriers. They identified as stimulating factors willingness to learn about another culture, opportunities to learn host language, and common interests.

Tanaka and colleagues (1997) devised variables indicative of integration into the host environment, which collectively they referred to as network development. Network development was defined through a variety of variables such as proportion of: equitable relations, frequent contact members, on-campus relationship, host members, and satisfying relationships. It was positively associated with four types of adjustment. Academic support and contact frequency were the most important predictors of adjustment among network structure elements.

The third and closely related category is satisfaction. Sam (2001) studied self-reports of satisfaction with life and factors predicting it of international students in Norway and found academic stress negatively affected satisfaction.

Stokes (1983) attempted to predict satisfaction with social support from attributes of one's social network structure. Satisfaction was measured by asking about general satisfaction with the network, amount of desired change in the network, satisfaction with assistance in daily activities, and satisfaction with emotional support. Stokes (1983) found strong emotional support networks the most powerful predictor of satisfaction. Satisfaction with their social networks was tied to the number of confidants in ego's network.

Social Network and Social Support Studies of International Students

Several researchers studied the social networks of international students with a particular interest in the student's social support needs. These studies are discussed below in the context of social networks and support needs.

Social Network Studies of International Students

Maundeni (2001) studied supportive and non-supportive links in social networks of African students to learn their perceptions of their adjustment to British society. He found advisors and lecturers played a significant role in academic support and in acclimating students

to their new education setting. Advisors helped with selecting research topics and sources and lecturers facilitated academic support; yet, academic dialogue during classes remained a significant source of stress.

Social Support Studies of International Students

Tanaka and colleagues (1994) suggested that social support be examined by looking at specific types of support from those identified by sojourner as being important. The name generator question asked for the names of ten people with whom the student had had an important relationship while in Japan. They studied the effect of demographic traits of supporters and relationship characteristics (type of relationship, frequency of contact, perception of equity, and more) on the perception of available support. Using the social network structure of international students in Japan, these researchers measured support expected and support actually received, for three types of social support (academic, interpersonal, emotional) by sources of support (academic advisor, tutor, friends off campus and other international students). They found that the frequency of support and number of providers of on-campus support from advisors and tutors decreased for academic, interpersonal, and emotional support over a year period. No change was seen in the support provided by international student sources over time.

Demographic attributes (e.g., age, sex, type of relationship, and role relationship) were sought on the network members. Respondents were asked to indicate the network member's dependability on a three-point scale for seven types of social support. Satisfaction with the relationship was also measured on a four-point scale.

Several types of social support were examined. Academic support included language, host culture and customs, and academic activities; daily life support included consultation, recreation, material and financial support and information on daily life activities. Expected

support was examined for each of the social support types from each relationship type. Language support, for example, could be expected from those encountered daily, relatives, and host family; but little could be expected from live-in family members and university staff. Academic support was expected of advisor, lab partner, and tutor but not family, relatives, and off-campus friends. Academic advisor and tutor were relied on for materialistic support.

The following results occurred for the academic component in particular: 37.5% of relationships were on-campus student relationships (same lab member 11%, Japanese tutor 3.7%, and other students 22.8%) and 17.1% were university staff (academic advisor 11.6%, other university staff 5.5%). On campus relationships were associated with instrumental support; off-campus relationships were linked to emotional support (Tanaka et al., 1994). Students relied more heavily on host relationships for academic support and cultural learning.

Summary

International students must learn and then apply the rules and regulations required of their new educational environment. Success is a function of their support networks. In her host environment, the international student must create a support network, anew. The attributes of that network (size, homogeneity, density, and solidarity, for example), will affect the level of support and the strength of the ties will affect access to resources.

This concludes a review of the pertinent literature. Methodology is presented in the next chapter.

CHAPTER THREE

Methods

Different types of relationships provide different types of support (Walker et al. 1994). Social support studies, because they tend to focus on a specific type of support, address a small percentage of active ties in the personal network (Walker et al., 1994). Similarly, my research is a study of a thread of the ego-centered networks of Chinese and Indian graduate students. The thread of interest was that portion of the personal social networks devoted to facilitating support related to making their way through the university system. Comparatively, other threads of the Chinese and Indian graduate student's social network might represent academic support, emotional support, friendship, or recreation, and each support thread could have different network members and a very different network structure.

The primary purpose of this study was to identify and examine the support networks of Chinese and Indian graduate students to understand who provides the support, satisfaction with the network, and the effect of the network on academic progression. The secondary purpose was to uncover network typology and test network theory using several network variables including homogeneity, solidarity, and density at the network structure level and tie strength at the relationship level.

Specifically, the study was designed to explore the following research questions:

1. *What are the characteristics of university system support networks of Chinese and Indian graduate students? Who provides support? What are the attributes of the providers?*
2. *What are the structural attributes of the support networks? How does the structure of the network affect the provision of support?*

3. *What is the effect of network structure on academic goals? How does the support network influence the achievement of academic goals?*
4. *How are the networks of Chinese and Indian graduate students similar and how do they differ in terms of size, homogeneity, solidarity, and density? What are the implications for satisfaction and effectiveness? Do social network theories related to variables at the structural level (homogeneity, density, solidarity) and relational level (closeness) hold true for the support networks of the Chinese and Indian graduate student populations?*

This chapter describes the research methodology that derived and enabled the study of the social support networks of Chinese and Indian graduate students. It is organized into four sections: population, research design, study biases, and data collection and data analysis.

Population

The Chinese and Indian graduate student populations were of interest for several reasons. Primary among them is volume. Together, Chinese and Indian students represent a significant number of the international students in the U.S. (see Table 1 in Chapter Two). Second, these students need to create new support networks in their new environments. And, thirdly, these support systems typically result in networks of similar others such as non-host student sojourners of similar cultural backgrounds. What do these networks look like for support related to progression through the university system, and what are the effects?

There are a significant number of students from China and from India on the Blacksburg, Virginia campus. Understanding from whom they obtain this type of social support will offer insight into optimizing resource delivery. Understanding what affects network satisfaction and what affects academic goals and progression will aid university social support efforts.

Culture is clearly at play in the formation of one's social networks. Culture provides boundaries on network formation in some cases and enables network formation in others. Culture can encompass ethnicity as well as cultural aspects of the academic discipline. Cultural implications of these student's networks is not a focus of this study. It is mentioned here to acknowledge the likely role that culture plays in network formation.

Prior to conducting this study, I sought approval from the Institutional Review Board for Research Involving Human Subjects of the university where the research is being conducted. Once granted, I obtained email addresses from the university (Virginia Tech) of the full-time Chinese and Indian graduate students registered Spring 2003.

Research Design

Theories and applications of the social network perspective focus on patterns and relations among interacting units. The *unit of analysis* is the relation or a collection of individuals and the ties among them. The *unit of observation* is the entity upon which the measure is taken; in other words, the network member. Social network data are most often collected by observing, interviewing, and questioning ego and/or network members about their ties. The social network methods I used to gather data on the social networks of the Chinese and Indian students follow.

Identifying Network Members

Respondents self-identified networks using a *name generator* which bound the identification of network members to the thread of social support being studied. This nominalist approach differs from traditional research approaches which determine the population of study based on realist boundaries such as students in a classroom. I decided to use a single-question name generator (Bochner et al., 1985; Burt, 1984, 1985; Fisher, 1982; Marsden, 1987; Ruan,

1998; Wellman, 1979) which met my research needs and was acceptable to the populations targeted in this research.

Social support needs were derived through discussions with Chinese and Indian students and personnel in two university departments that assist international students. The list of needs ultimately included university and academic rules and regulations; community-related requirements; and, state and federal requirements. The specific needs associated with this thread of support are displayed in Question 2 of the survey instrument (Appendix A).

Attributes of Network Members

A second unique research approach used by social network researchers is the *name interpreter* question. These questions are used to derive attributes of the network members. Name interpreter questions uncovered demographic similarity (or homogeneity), family roles, university roles, other roles, relationship strength, and fluency in English.

Measuring Tie Strength

Relationships are the focus of social network studies and tie strength is an important network variable measuring the strength of the relationship. There is some debate about how to best capture tie strength. Interaction frequency is often used as a measure of strength; however, Marsden and Campbell (1984) argue this measure is inadequate because it tends to include effects of external constraints rather than instrumental action. For example, neighbors may see one another daily but their frequent interaction may not correlate with support. For this reason, I have used closeness of friendship as a proxy for tie strength. Tie strength is measured on the relationship between student and network member and the relationships among network members.

Network Size

Social network researchers tend not to limit respondent's identification of the number of network members; that is, network size. However, researchers have often limited the number of network members on whom they will solicit name interpreter data (Burt, 1984, 1985; Marsden, 1987; Wellman, 1979, 1982) meaning the number of network members they will study. Burt (1984) and Marsden (1987) each limited their name interpreters to five network members, and Wellman (1979), limited his to six network members. I asked respondents to identify a network size; that is, I asked for the number of people who provided the types of support listed, and, like the studies cited, limited the name interpreter questions and network analysis to four individuals.

Name interpreter questions were carefully designed to answer the research questions and to maintain respondent and network member anonymity.

Variables

The study of social networks involved capturing data on ego, on network members, and on the relationships between ego and network members and among network members. The complete list of independent variables is shown in Table 2. Tie strength (closeness) is a property of the relationship. It can be a dependent or independent variable depending on the context. It is shown in Table 2 as an independent variable associated with the relationship. This study included three dependent variables: network size, satisfaction with the network, and effectiveness of the network. These are presented in Table 3 along with their definitions and information on their derivation. Table 4 presents three derived variables, their definitions, and the variables contributing to their derivation. One of the derived variables is a measure of homogeneity; the other two are measures of connectedness.

Table 2

Independent Variables of Ego, Network Member, and Relationship

Variable	Ego	Network Member	Relationship
Sex	X	X	
Marital/partnered status	X	X	
Country of origin	X	X	
English language ability	X	X	
Same mother tongue		X	
Time at university	X		
Employment status at university	X		
Listserv membership	X		
Roommates Spring 2003	X		
Age	X		
Number of children	X		
Number of children live with	X		
Social Support Needs	X		
Closeness			X
Family relationship		X	
Student role		X	
University roles		X	
Other types of connections		X	

Table 3

Definitions and Derivations of Dependent Variables

Variable Name	Definition	Derivation
Network size	The number of individuals who provide the specific support described in this study	Derived from a question asking for the number of providers of support.
Satisfaction with support	Measure of ego's satisfaction with the network to provide needed support.	Derived from a needs-based question asking whether network size was sufficient to meet ego's needs.
Progression toward academic goals	Measure of the effectiveness of the network to provide support sufficient to enable academic progression.	Derived from question asking whether assistance received enabled, was a barrier to, or had no effect on academic progression.

Table 4

Definitions and Source Data for Derived Variables

Variable Name	Definition	Input Data
Demographic homogeneity	Measure of sameness on 4 parameters: sex, country of origin, marital/partner status, and native language/mother tongue.	Sex, marital/partnering status, country of origin, mother tongue/native language
Density	Measure of presence of ties.	Derived from variable closeness.
Solidarity	Measure of closeness of network members with other network members.	Weighted value of closeness.

Influencing response rate

I am neither Chinese nor Indian, and I was concerned about response rate given I am not one of their own. I took several steps to build bridges and positively influence my response rate. I spoke with nearly 200 Chinese and Indian students and distributed flyers at a campus-wide international student registration function. The flyers contained the purpose of the study, my name, my email address, and the weeks in which students should expect to receive an email message from me requesting participation. I hoped that they would remember having spoken with me and participate in the survey.

I also sought input from the Chinese and Indian students on survey design. On two occasions I met with students (~10) in an Engineering class to derive the social support needs and to gain insight into their world and experiences. Later, some (~6) reviewed the survey questions and offered suggestions. Some (~4) contacted me via email later offering to pre-test the survey. I was invited to attend a Bible study class off-campus where many Chinese students gathered. There, several (~6) more students offered to pre-test the survey. I also met with students (~4) at the university student center to discuss the instrument. They offered suggestions on question formatting and ways to increase participation. They also suggested I secure support from the leadership of the Chinese and Indian student associations and that I offer incentives. Working with approximately 30 students on survey design and conduct of survey helped ensure internal validity of the survey instrument.

Conducting the Survey

I surveyed the entire populations of Chinese graduate students and Indian graduate students via an instrument posted on a University server. Three students who provided extensive input into survey design and conduct of the survey were not included in my sample. Each

Chinese and Indian graduate student enrolled Spring 2003 was sent an email message soliciting his or her participation in the survey. Reminder notices were sent three times to all students increasing the response rate. I also offered an incentive ($10 gift certificates to a local grocery store) to respondents who provided their email addresses. Names were drawn after the close of the survey and ten students were contacted via email to arrange for delivery of their gift certificates.

Validity and Reliability

External validity (the extent to which the results can be generalized to the population) was also considered. The entire populations, not samples, were studied in this research. Generalizations are limited to the populations being studied – full-time Chinese and Indian international graduate students at this university.

Social network researchers have found test-retest methods to ensure reliability problematic for social network studies where social phenomena typically vary over time (Wasserman et al., 1999). Test-retest methods will not distinguish between error in measurement and actual change in the network over time (Walker et al., 1994). Test-retest methods are not a factor in this research.

Data Collection and Data Analysis

I designed a Web-based survey instrument to facilitate this data collection. Data were collected on ego, on social support needs, on up to four network members, on the relationships between ego and each network member, and on the relationships among the up to four network members. Figure 1 presents the social network under study with associated data collection and data analysis points. The figure portrays Chinese and Indian graduate students driven by social support needs seeking assistance from others, and Persons 1 through 4 providing requested

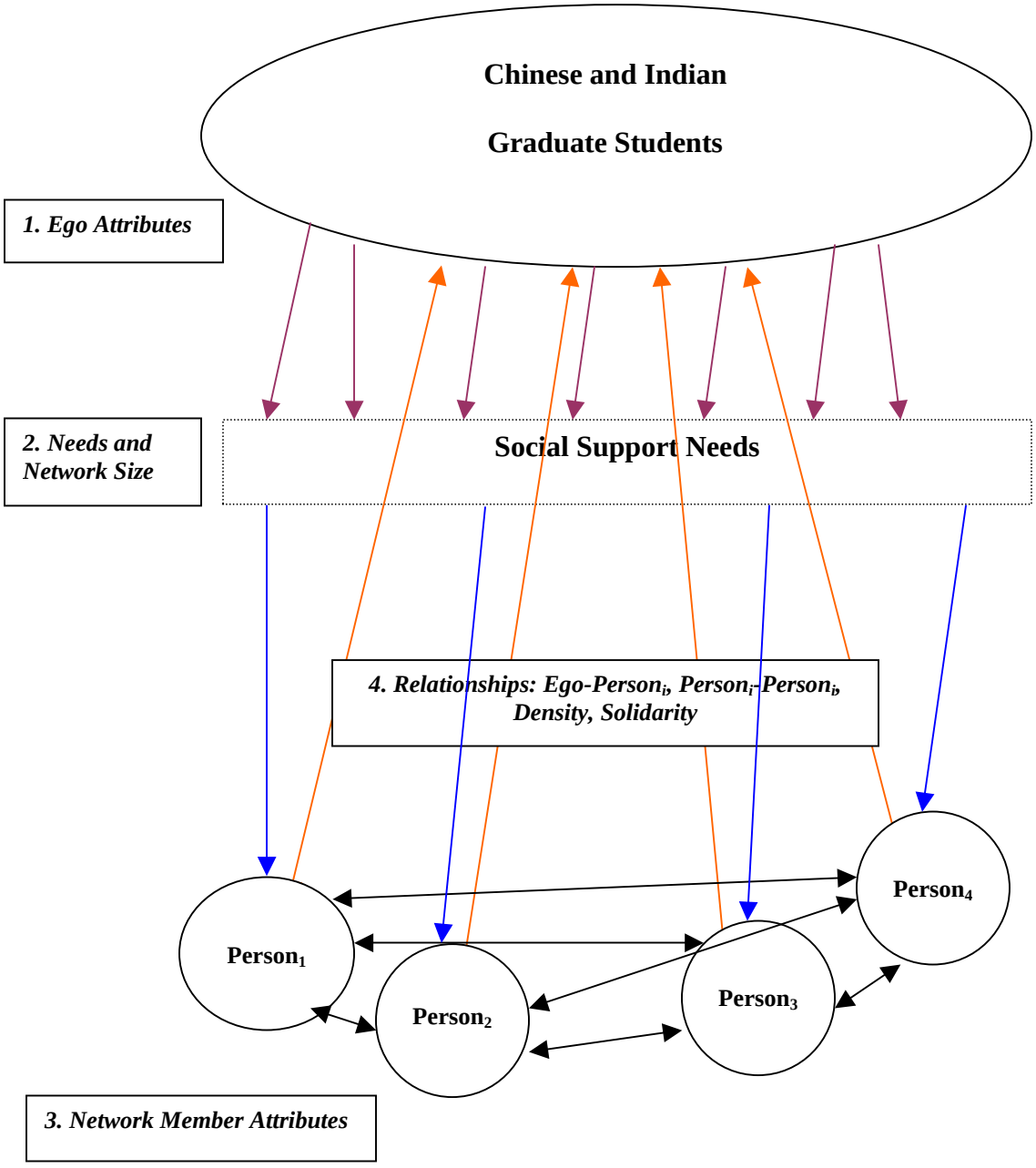

Figure 1. Social network model with four data collection/data analysis points: ego (student respondents), social support needs, support providers/network members, and relationships between ego and network providers and among network providers.

assistance to the student. Data collection and analysis were conducted on each of 1 through 4 in Figure 1 – ego attributes, needs and network size, network member attributes, and relationships between ego and network member and among network members.

The survey (Appendix A) contained five major sections (a) demographic characteristics of respondent, (b) needs, (c) attributes of network members, (d) density and solidarity of network members, and (e) satisfaction and effect of network on academic progression. Together, the responses to the questions defined a network typology, identified attributes of networks and network members, and enabled the study of variables associated with network theory. In most cases, analysis was conducted and is presented by sex and country of origin. In the discussion below and tables that follow, the term *group* is used to refer collectively to Chinese male, Chinese female, Indian male, and Indian female.

Section A – Respondent (Ego)Demographics. This section of the survey facilitated an understanding of the Chinese and Indian populations or ego attributes. Minimal information was asked about each respondent. This was especially important for Chinese respondents who in the design phase voiced concern over invasive questions and their desire for anonymity.

Demographic details included country of origin, sex, age, marital/partnered status, number of children, residence, English fluency, and length of time in the U.S. Contingency tables were generated for each variable and chi-square analyses and in some cases Fisher's Exact tests, depending on cell size, were conducted to test for significant differences by sex and country of origin.

Section B – Social Support Needs. The goal of this section was to understand the needs of Chinese and Indian graduate students and the number of network members who provided this type of support. Respondents were asked to check, from the list provided, those needs for which

they had sought and received assistance. All 20 needs were categorized into one of three categories (university related needs, federal/state related needs, and community related needs) and the frequency and percent of students having experienced each need reported. Also, by need category, the mean number of needs experienced and the percent of students having experienced the need category were presented. An ANOVA was run on all needs to test for effects of sex, country of origin, and the interaction of sex and country of origin on need categories.

A second question in section B of the survey asked for the number of individuals who provided the types of support listed. This became the variable network size. Ranges were provided for student's responses (e.g., 1-3, 4-6). Contingency tables were generated and frequencies and percentages by network range were presented by group. The mid-point of the network range was used to compute a weighted average network size by group. An ANOVA was run to test for effects of sex and country on network size and a chi-square analysis tested for independence in sex and country of origin.

Section C - Attributes of Network Members. The objective of this section was to understand who the network members were, how similar they were to ego, and how similar they were to one another. Respondents were asked to think about the first four individuals they thought of when answering the question about network size. This was the name generator question. The four individuals became the social support network of study. To preserve anonymity of ego and network members, respondents were not asked to identify network members by name; instead, network members were referred to as Person 1, Person 2, Person 3, and Person 4. The number of individuals in the networks of these students decreased from Person 1 to Person 4. Frequency and percent number of Persons 1, 2, 3, and 4, were generated and an

ANOVA was run to test for effects of sex, country of origin, and the interaction of sex and country of origin.

Attributes of the individual network member were generated using name interpreter questions. These questions elicited information on closeness, family relationship, student status, university role, English fluency, demographic homogeneity (sameness of sex, ethnicity, mother tongue, and country of origin), and other ways in which respondent was linked to the network members.

All variables were analyzed similarly. First, contingency tables were generated for each variable across all four network members. Second, chi-square analyses were conducted to test for significant differences between country testing Chinese male and Indian male, Chinese female and Indian female, and to test for significant differences between sex testing Chinese male and Chinese female, and Indian male and Indian female. In cases of small cell size, cells were combined and the analyses run again. Where significant differences were uncovered, an additional chi square analysis was conducted to determine where the differences existed. A probability level of .05 was used for significance. And, third, independence was tested by group (Chinese male, Chinese female, Indian male, Indian female) across all across all network members (chi-square).

Several types of relationships were of interest in this study; foremost was the strength of the relationship between ego and network member. This was evaluated through the variable closeness also referred to as tie strength. Closeness was measured by a value between “0” and “3”. The closer the friendship between ego and network member, the stronger the tie strength, and the closer to the value to “3”. A fourth test was applied to the variable closeness. An

ANOVA was run to test for effects on overall tie strength across all network members across all groups.

Demographic homogeneity was a way to highlight the similarities (and differences) between ego and the members of his or her network and to help characterize the network structure. It was derived from the four demographic parameters: sex, marital/partner status, country of origin, and native language/mother tongue. A value of "1" was assigned to each parameter for which ego and network member were same. The values were summed across network members for all four parameters and a percent same of percent possible sameness in demographic homogeneity was computed. This value was demographic homogeneity. Mean demographic homogeneity was also computed by group for each network member (Person 1, 2, 3, and 4). Two additional tests were conducted on demographic homogeneity beyond the three identified for all variables. The first was a chi-square analysis on the parameters of demographic homogeneity by network member. The second was the computation of average demographic homogeneity by group for each network member.

Section D – Relationship Data and Analysis. In addition to the relationships between ego and network member, the relationship among network members was also of interest. A question in Section D asked respondents to characterize each possible relationship among network members as *close personal friends, just friends, know one another slightly,* or *do not know one another*. The responses were used to measure density (a measure of ties present of all possible) and solidarity (a measure of strength of those connections).

Network density was computed per respondent. Responses to the variable closeness between network members were coded "1" if any type of relationship existed, and "0" otherwise. The formula for density is 200*a/[n(n-1)] where a = number of non-redundant links among

network members and n = number of network members identified (Niemeijer, 1973). Mean percent density was computed by group, by sex, and by country.

Solidarity was also derived per respondent and the mean computed by group, by country, and by sex. Values of "0","1", "2", and "3" were assigned to responses *don't know person well, casual friend, friend,* and *close personal friend,* respectively. The formula for solidarity (Blieszner, R. personal communication, April 10, 2003) is [200(b+2c+3d)/3]/[n(n-1)] where b = number of casual friend links, c = number of friend links, d = number of close personal friend links, n = number of network members identified.

ANOVAs were conducted to test for main effects (sex and country) on density and solidarity. Logistic regressions were conducted to look for predictive relationships of these variables on the dependent variables, network satisfaction and network effectiveness.

Section E - Satisfaction and Effectiveness. Another goal of this study was to learn about student's satisfaction with their networks and about the effect on progression as a result of that support network. These two dependent variables (satisfaction and effectiveness) were addressed in two questions. Network satisfaction was determined by asking whether respondent's network size was sufficient or whether respondent would prefer more people from whom to get similar assistance. A single question, designed to measure effectiveness, asked whether assistance received for the identified support needs *enabled, was a barrier to,* or *had no effect* on progress toward achieving a degree. One student responded that the network was a barrier. That response was combined with the *had no effect* responses.

Mean percent responses by group were computed for each variable. Chi-square tests of significance were conducted on these dependent variables and an ANOVA also conducted to test

for effects of sex and country of origin. Logistic regression tested for associative behaviors of independent variables on satisfaction and effectiveness.

A final question in Section E was an open-ended question asking for any comments the respondent wished to make. The results of these were reviewed. Some comments added insight into the results and were included in the conclusions in Chapter 5.

Four Research Questions

The data from the above all feed responses to the four research questions. These were identified at the beginning of this chapter. My research design allowed the use of variables to answer multiple questions. Table 5 presents, by research question, the analytical methods used to analyze and respond.

Summary of Data Analysis

Survey data were downloaded from the server in text format, uploaded into an excel spreadsheet, and imported into a SAS dataset. Incomplete surveys were eliminated from the results. Data analysis was, in large part, descriptive statistics. A significant portion of this research contained categorical data and the analytical tool of choice for categorical data is the chi-square. In some cases, where appropriate, ANOVAs were conducted. Comparative analyses were conducted using contingency tables and chi-square analyses. Where results showed questionable differences, chi-square analyses were conducted to test for significant differences. In situations where cell sizes fell below 5, I reported the results of the Fisher's Exact test. A *p*-value of .05 was used.

Table 5

Analytical Methods by Research Question

Research Questions		
No.	Question	Analytical Methods
1.	Network characteristics, network member attributes	Contingency tables, Chi-square to test for significant differences, and ANOVAs to test for main effects
2.	Structural attributes and effect on satisfaction	Contingency tables, chi-square to test for significant differences, ANOVAs to test for main effects, and logistic regression to test for effects of variables on dependent variables.
3.	Effect of structure on academic goals	Chi-square to test for significant differences, ANOVAs to test for main effects, and logistic regression to test for effects of variables on academic progression
4.	Similarity and differences in networks and implications for satisfaction and for academic progression	Analyze results generated above. Test implications of significant results on satisfaction and progression using logistic regression.
4.	Consistency with literature of variables homogeneity, density and solidarity and of tie strength	Analyze results generated above; discuss expectations as result of findings.

Results highlighted the patterns, relationships, and significant differences between demographic traits of ego and network member attributes. They also highlighted the relationship between the ego and network member variables, and network satisfaction and academic progression. I used logistic regression to analyze the predictive effects of a variety of variables on network satisfaction and on academic progression.

Testing the findings of several social network variables and theories was another goal of this research. The final research question involved testing claims of social network variables like homogeneity, density, solidarity, and testing theory of tie strength on these populations. Logistic regressions were applied to these variables to test for predictive relationships.

This completes the discussion of the research methodology used in this study. The design was deemed appropriate to address the questions posed in this study. Chapter Four provides an analysis of the results of this research.

CHAPTER FOUR

Findings

This study examined the social support networks of Chinese and Indian students as they related to student's making their way through the rules and regulations of their host university system. The support network was bound by needs articulated by these students and by university staff who provide support to these students. I wanted to understand who provided support, homogeneity of the network members with ego and with one another, closeness of ego to network member, and the size, density, and solidarity of the networks. I also wanted to know whether students were satisfied with the size of their support networks and the effect of these support networks on their academic progression.

The population of full-time Chinese (296) and Indian (322) graduate students registered Spring 2003 was surveyed. Of the 618 students, 48% were Chinese and 52% were Indian, 70% were male, and 30% were female. Chinese males and females represented 29% and 19%, respectively, and Indian males and females represented 41% and 11%, respectively, of the population. At the close of data collection, a total of 225 students had responded yielding 208 usable responses and a response rate of 34%.

Results are presented and discussed in the context of the parameters of study (ego, network member, and relationship between ego and network member), network structure (size, density, solidarity, and homogeneity), and effects of the network on satisfaction and academic progression.

Most of the following analyses are presented by the sample groups: Chinese males, Chinese females, Indian males, and Indian females. The term *group* is used to refer to these four groups and is used most often to describe the presentation of the variables by country by sex.

Ego Attributes and Characteristics

Demographic attributes such as sex by total sample and by country, marital/partnered status, respondent's English language ability as compared with peers, age, and number of children are presented by group in Table 6. Frequencies and percents associated with university- and community-related attributes of ego such as length of time ego had been at the university, university employment status, membership in a nationality-based listserv, and who they lived with Spring 2003 are presented in Table 7. Chi-square analyses reflect analysis on the basis of sex, on the basis of country, and on the basis of groups where all four groups were combined into one variable.

Country and Sex. Forty-three percent of the Indian population and 23% of the Chinese population responded to this survey. The sample contained significantly more Indian students (N=139, 67%) than Chinese students (N=69, 33%) and significantly more males (148) than females (60), although the sex distribution of the sample (71% male and 29% female) compared favorably with that of the population (70% male, 30% female). Table 8 shows the significant differences in sex and country.

Age. Overall average age of the sample was 25.8. Average age was 28 for the Chinese students, 25 for Indian students, 27 for females, and 25 for males. Table 6 shows greater detail. Pooled T-tests showed significant differences in mean age by country and by sex (Table 9).

Marital/Partnered Status. Seventy-four percent of the sample was not married/partnered (see Table 6). This figure reflects significantly more Indian students (93%) than Chinese students (36%). Chinese students were significantly more likely to be married/partnered than Indian students (Table 10) and significantly more Chinese males than Indian males were married/partnered.

Table 6

Frequency and Percent of Demographic Attributes by Group

			Chinese				Indian			
	Total		Male		Female		Male		Female	
Demographic	N	%	N	%	N	%	N	%	N	%
Sample - Percent of Total	208		33	16	36	17	115	55	24	12
Percent by Country	208		33	48	36	52	115	83	24	17
Age										
< 24	57	27	1		0		48		8	
24-26	78	38	5		10		51		12	
27-29	48	23	17		15		14		2	
30-32	16	8	8		6		1		1	
32+	8	4	1		5		1		1	
Average Age	25		28		28		24		25	
Married/Partnered	55	26	20	61	24	67	6	5	5	21
English ability compared with peers										
Better	75	36	10	30	12	33	46	40	7	29
Same as	121	58	16	48	22	61	68	59	15	63
Not as good	12	6	7	21	2	6	1	1	2	8
Number of Children	8		3		2		2		1	

Table 7

Frequency and Percent of University- and Community-Related Attributes by Group

University and Community-Related Attributes	Total		Chinese				Indian			
			Male		Female		Male		Female	
	N	%	N	%	N	%	N	%	N	%
Time at University										
<= 12 mos.	85	41	7	21	11	31	59	51	8	33
> 12 mos	123	59	26	79	25	69	56	49	16	67
Employed at University	179	86	30	94	28	78	104	90	17	74
Student Resides With										
Just Friend	144	69	12	36	9	25	104	91	19	80
Just Spouse	29	14	11	33	14	39	3	3	1	4
No One	14	7	4	12	4	11	4	3	2	8
Other	21	10	6	18	9	25	4	3	2	8
Nationality-based Listserv	152	73	24	73	27	75	80	70	20	83

Table 8

Sample Distribution by Country and Sex

Variable	N	df	χ^2
Country	208	1	23.56*
Sex	208	1	37.23*

* $p < .05$

Table 9

Mean Differences in Age by Country and by Sex

Variable	N	df	*T*
Country	206	204	10.62*
Sex	206	204	-3.77*

* $p < .05$

Table 10

Effects of Sex and Country of Origin on Ego Attributes

Variable	Test Groups	N	*df*	X^2
Marital/Partnered Status		208	1	46.17*
	Sex	208	1	20.78*
	Country	208	1	73.96*
	All Groups	208	3	76.77*
English Ability		208	2	86.38*
	Sex	208	1	.75
	Country	208	1	10.14*
	All Groups	208	6	20.57*
Time at University		208	1	6.94*
	Sex	208	1	2.95
	Country	208	1	9.33*
	All groups	208	3	12.61*
Employment at University		206	1	112.16*
	Sex	206	1	8.19*
	Country	206	1	23.00
	All Groups	206	3	8.62*
Reside with (combined)		208	1	78.77*
	Sex	208	1	10.80*
	Country	208	1	60.00*
	All Groups	208	3	61.46*
National Listserv Membership		208	1	42.48*
	Sex	208	1	1.40
	Country	208	1	.09
	All Groups	208	3	2.03

*$p < .05$

English Language Ability. Language, the predominant mode of communication, affects network formation and utilization. Fifty-eight percent of the sample believed their English language ability was about the same as that of their peers (see Table 6). Another 36% believed their language ability was better than their peers. Over 20% of Chinese males believed their language ability was not as good as their peers which contrasted sharply with the small percentage of Indian male (1%), Indian female (8%) and Chinese female (6%) who reported the same. Chi-square tests for independence were conducted after combining *about the same as my friends* with *not as good as my friends* because of small cell values. Significant differences were seen by country as more Indian students have stronger English language skills than Chinese students (see Table 10).

Children. Ninety-three percent of the Chinese and Indian students do not have children (Table 6). Four percent (9 students) indicated having children and of those, seven have children who live with them. Of those who have children living with them, two have at least one child in school and five have children who do not attend school. Another 22% (two students) indicated their children do not live with them. This was of interest because research indicates that children who attend school are an important source of cultural information and language skills. No further analysis was conducted on this variable because of the small values.

Time at University. Overall, 59% of Chinese and Indian students, and significantly more Chinese (74%) than Indian (52%) students, had been at the university for more than 12 months (Tables 7 and 10). Indian students tended to have been at the university less than 12 months.

Employed at University. Eighty-six percent of Chinese and Indian students were employed at the University (see Table 7). This percentage represents significantly more males than females (Table 10).

Residence. Sixty-nine percent of the sample lived only with friends, another 14% lived with just a spouse, and seven percent lived alone (see Table 7). The remaining 10% lived with other (5%), spouse plus a friend (2%), spouse plus children (1%), spouse plus other relative (.005%), spouse plus children plus other relative (.005%), or friend plus other (.005%). As a result of small cell sizes, categories were combined prior to running chi-square analyses testing for differences and patterns in living arrangements. The first category combined family-related choices (*my spouse/partner, my children,* and *other relatives)* and the second combined friend and other choices (*friends, no one,* and *other*). Significant differences are seen in both country and sex (Table 10). Significantly more Chinese lived with family relatives than did Indian students, significantly more Chinese males (43%) lived with family than did Indian males (3%), and significantly more Chinese females (42%) lived with family than did Indian females (10%).

Listserv. Seventy-three percent of Chinese and Indian students indicated they were members of a nationality-based listserv (Table 7). The variable listserv showed significant differences (Table 10) that were not seen at the less aggregated levels.

In summary, variables sex and country proved significant for martial status and residence. Sex alone was significant for employment at the university and country alone was significant for English ability and time at university.

Social Support

Needs

The thread of social support studied in this research involved the rules, regulations, and requirements that students encounter as they make their way through the university system. Twenty needs were derived from discussions with Chinese and Indian students. There was substantial agreement on the specific needs that were relevant to the type of instrumental support covered by this research. These needs were grouped into three categories: university needs, federal/state needs, and community needs. Table 11 identifies by specific need within each need category and the frequency and percent of students who sought and received assistance.

These social support needs, because they were derived by the population, were expected to be highly representative of situations the students encountered. Honor code rules and regulations (38%), research lab rules (39%), negotiating rental agreements (38%), and utilities (37%) were among the least frequent items for which students needed assistance. Alternatively, over 70% of the sample needed assistance with selecting a class (80%), learning about VISA and INS requirements (79%), state and federal income tax information (79%), registering for classes (76%), and obtaining a driver's license (71%).

Table 12 shows, by group and need category, the mean number of needs students experienced for each of the three need categories. It also shows the percent of students who experienced each category of need. The cumulative mean per student group (at the bottom of the table) reflects the cumulative total of all three groups of needs. Overall mean needs is the overall average of the needs experienced in the respective need category.

Chinese students especially males had more needs than Indian students. Females tended to have significantly less demand for federal/state needs than males.

Table 11

Frequency and Percent of Students who Sought and Received Support by Needs

Category	Social Support Needs	N	Percent
University Needs			
	Selecting a class	166	80
	Registering for classes	159	76
	Completing a plan of study	135	65
	Understanding requirements of academic dept.	133	64
	Understanding graduation requirements or deadlines	122	59
	Understanding university services available to you	104	50
	Other similar to university-related information	90	43
	Selecting an advisor	87	42
	Understanding rules, regulations, requirements of research lab	82	39
	Understanding honor code rules, copyright rules, etc.	79	38
State/Federal Needs			
	Visa or INS requirements	165	79
	State or federal tax requirements	165	79
	Other federal or state information	77	37
Community Needs			
	Obtaining a driver's license	147	71
	Health Insurance	139	67
	Banking	127	61
	Other similar	88	42
	Immunizations	86	41
	Negotiating rental agreements	80	38
	Utilities	76	37

Table 12

Mean Number of Needs and Percent of Students Experiencing Support by Need Category

Need Categories	Overall Mean Needs	Chinese				Indian			
		Male		Female		Male		Female	
		Mean Needs	% Students	Mean Needs	% Students	Mean Needs	% Students	Mean Needs	% Students
University (N=10)	5.6	6.2	94	6.1	94	5.3	93	5.3	92
State/Federal (N=3)	2.0	2.3	85	1.7	64	2.0	76	1.7	54
Community (N=7)	3.6	4.3	91	3.3	72	3.4	77	1.7	75
Cumulative Mean (all 3 need categories)		13		11		11		11	

Chinese males experienced more needs on average (13) than the other student groups (11). Over 70% of students needed community assistance and over 80% needed university assistance. Significantly more males than females experienced federal/state needs (Table 13).

The focus of this social network study is on the networks of Chinese and Indian students. Needs have been presented only to define the social network. The discussions that follow highlight the characteristics of the social networks of these students as they related to the types of instrumental support identified.

Network Size

Network size identifies the number of contacts from whom respondents solicited and received support. The network sizes varied (Table 14). Over 50% of Chinese males and nearly 45% of Chinese females had networks of 10 or more members. Conversely, only 31% of Indian males and 17% of Indian females had networks of 10 or more members. One individual indicated he had 0 network members. That response was combined with the category 1-3 network members and the new response label was < = 3 network members. I also computed a weighted average of network size (using the midpoint of each range) as a proxy for mean network size (see Table 14).

Differences were significant between country (Table 15) where significantly more Indians had fewer members in their networks than Chinese. Additionally, males (35%) tended to have more network members in the 0-3 range and females (35%) more in the 4-6 range. Results of tests for independence (Table 16) showed no significant differences.

Table 13

Effects of Sex and Country of Origin on Needs (N=208)

Need Category	Test Groups	*df*	Type III SS	F
All Needs				
	Sex	1	32.27	1.21
	Country	1	59.42	2.23
	Sex * Country	1	23.43	.88
University Needs				
	Sex	1	.14	.02
	Country	1	25.37	.39
	Sex * Country	1	.16	.02
State/Federal Needs				
	Sex	1	9.35	10.90*
	Country	1	.77	.89
	Sex * Country	1	.39	.45
Community Need				
	Sex	1	5.08	1.05
	Country	1	3.22	.66
	Sex * Country	1	14.59	3.01

*$p < .05$

Table 14

Frequency and Percent Network Size by Group

			Chinese				Indian			
			Male		Female		Male		Female	
Network Size	N	%	N	%	N	%	N	%	N	%
0	1	.5	0		0		1	1	0	
1-3	64	31	6	18	8	22	44	39	6	25
4-6	51	25	8	24	10	28	22	19	11	46
7-9	20	10	2	6	3	8	12	11	3	13
10+	71	34	17	52	15	42	35	31	4	17
Total	207	100	33	100	36	100	114	100	24	100
Weighted Avg. of Network Size	6.1		7.2		6.7		5.6		5.5	

Table 15

Effects of Sex and Country of Origin on Network Size

Variable	Type III SS	*df*	F
Sex	.96	1	.62
Country	10.74	1	6.92*
Sex * Country	.11	1	.07

*$p < .05$

Table 16

Differences by Sex and Country of Origin on Network Size

Variable	N	*df*	χ^2
Sex	207	4	5.84
Country	207	4	9.40
Sex*Country	207	12	18.54

Ego and Needs Summary

These Chinese and Indian graduate students had an overall average age of 25. Chinese students were significantly older than Indian students (28 vs. 25) and female students were significantly older than male students (27 vs. 25). There were significantly more males (71%) than females (29%) and more were Indian (67%) than Chinese (33%) students in the sample. Of females, there were significantly more Chinese (60%) than Indian (40%). Of males, there were significantly more Indian (78%) than Chinese (22%). More Chinese males (61%) were married/partnered than Indian males (5%), as were more Chinese females (67%) than Indian females (21%) and more Indian females than Indian males. Significantly more Chinese males (79%) have been at the university longer (more than 12 months) than Indian males (49%). Most Chinese students (74%) and 67% of Indian females had been at the university more than twelve months.

More Chinese males (94%) were employed at the university than Chinese females (78%) and significantly more Indian males (90%) than Indian females (74%). Significantly more Chinese males (43%) resided with family relatives than Indian males (3%) and significantly more Chinese females (42%) resided with family relatives than did Indian females (9%).

Over two-thirds of the students lived with a friend in Spring 2003 including 88% of Indian students. About one-third of the Chinese students lived with spouse/partner and another one-quarter to one-third lived with a friend. Not all married/partnered students lived with their spouse/partner; only 55% and 58% of Chinese male and female, respectively, and, 50% of Indian male and 20% of Indian female lived with their spouse/partner.

Most students (58%) believed their English language ability was about the same as their peers; however, nearly one-fifth of Chinese males believed their English language ability was not as good as their peers.

Needs were determined by the students of this study. Overall, Chinese students had more needs than Indian students and Chinese males had more than all other groups. Females tended to have significantly less demand for federal/state support needs than did males. On average, all types of needs combined, Indian students and Chinese females needed assistance with 11 of the 20 items listed. Chinese males needed assistance with 13 items.

Overall average network size was six members. Chinese students tended to have larger networks than Indian students and Chinese males larger than Chinese females. Significant differences were seen in network size as males especially Indian males (40%) tended to have fewer members (0-3) in their networks than females – 46% of Indian females had 4-6 members and 45% of Chinese females had ten or more members.

Network Members

This section focuses on the providers of support -- the network members. The number of network members per ego varied from one to four limited to four by the researcher and any number less than four by ego. Table 17 shows the number of total network members by group. Some respondents indicated having only one network member for the type of support covered by this research, others more. In all, 208 students discussed their first network member and 135 discussed four network members. Sex, country of origin, and the interaction of sex and country had no effect on network size (Table 18).

Table 17

Frequency and Percent of Number of Network Members by Group

			Chinese				Indian			
Number of	Total		Male		Female		Male		Female	
Network Members	N	%	N	%	N	%	N	%	N	%
One	208	100	33	100	36	100	115	100	24	100
Two	201	97	30	91	35	97	112	97	24	100
Three	170	82	26	79	32	89	89	77	23	96
Four	135	65	24	73	27	75	67	58	17	71

Table 18

Effects of Sex and Country of Origin on Number of Network Members in Student's Network

Variables	Type III SS	*df*	F
Network			
Sex	1.94	1	2.60
Country	.01	1	.01
Sex * Country	.36	1	.48

Network members were characterized across a number of variables including their closeness to ego, family relationships, student status, comparative English language ability, university role, and demographic homogeneity with ego which was comprised of four parameters: sex, marital/partner status, country of origin, and native language. Chi-square analyses were conducted on each of these variables to test for significance as a function of sex or country of origin by group and by network member. In some cases, where appropriate an ANOVA was also run to test for main effects.

Closeness

Close personal friends are closer than friends, who are closer than casual friends, who are closer than acquaintances. Closeness of friendship was used as a proxy for tie strength. Tie strength is one of the most significant variables of interest in social network research. It is indicative of a number of things including the degree of social support provided and access to resources.

Consistently, Persons 1-4 were most often a *friend* (43%) (Table 19). Differences appeared in the second most common response for closeness. After *friend,* Chinese males most frequently indicated Persons 1 and 3 were *close personal friends*, that Person 2 was a *casual friend,* and that Person 4 was an *acquaintance.*

Also after *friends,* Chinese females were most likely to have *close personal friends* as Persons 1 and 2 and an *acquaintance* for Person 3. Unlike all other groups, Person 4 was not

Table 19

Frequency and Percent Closeness by Network Member by Group

			Chinese				Indian			
	Total		Male		Female		Male		Female	
Closeness	N	%	N	%	N	%	N	%	N	%
Person 1 (N=208)										
Acquaintance	25	12	2	6	8	22	14	12	1	4
Casual Friend	26	13	2	6	1	3	18	16	5	21
Friend	94	45	17	52	14	39	53	46	10	42
Close Personal Friend	63	30	12	36	13	36	30	26	8	33
Person 2 (N=201)										
Acquaintance	31	15	2	7	6	17	19	17	4	17
Casual Friend	49	24	6	20	2	6	34	30	7	29
Friend	85	43	18	60	17	49	42	38	8	33
Close Personal Friend	36	18	4	13	10	29	17	15	5	21
Person 3 (N=170)										
Acquaintance	35	21	3	12	10	31	17	19	5	22
Casual Friend	28	16	1	4	3	9	17	19	7	30
Friend	76	45	17	65	13	41	38	43	8	35
Close Personal Friend	31	18	5	19	6	19	17	19	3	13
Person 4 (N=135)										
Acquaintance	36	26	5	21	11	41	16	24	4	24
Casual Friend	25	19	2	8	2	7	17	25	4	24
Friend	55	41	13	54	10	37	25	38	7	41
Close Personal Friend	19	14	4	17	4	15	9	13	2	12

likely to be a *friend,* rather he or she was most likely to be an *acquaintance*. Her second choice for Person 4 was *friend*.

After *friend,* Indian males were more likely to have *close personal friend* or *casual friend* as the second choice for Persons 1 and 2, respectively, and Person 3 had equal chances of being a *close personal friend, a casual friend* or an *acquaintance.* Person 4 also had a nearly equal chance of being either a *casual friend* or an *acquaintance*.

The networks of Indian females were also composed primarily of friends (40%). A close second for Person 1 was *close personal friends*. After *friends,* Persons 2 and 3 were most likely to be *casual friends,* and by Person 4, network members had an equal chance of being a *casual friend* or an *acquaintance*. At Person 2, behavior of Indian students overall differed from Chinese students as significantly more Indian students had weaker ties in their networks than Chinese.

Data were combined into two categories to add clarity to this analysis. The first category, called weaker links, combined *casual friend* and *acquaintance*. The second, called closer links, combined *friend* and *close personal friend*. While patterns are evident, an unreported chi square analysis resulted in no significant differences. Females (see Table 10) have the same percentage of weaker links (25%) at Person 1, slightly fewer than Indian males at (28%). At Person 2, Indian students had significantly more weaker links (46% and 47% females and males, respectively) than Chinese who had approximately 72% closer links. At Person 3, Indian males changed their behavior switching to closer links. Indian females continued to increase their weaker links. Chinese females, too, continued to increase weaker links but at a slower rate. Chinese males continued to have over 80% closer links at Person 3. By Person 4, Chinese female, Indian male,

and Indian females were similar in their network makeup: approximately 48% weaker links and 52% closer links. Chinese males had slightly fewer than 30% weaker links.

Overall, the first person in student's networks was a *friend* and then most often a close personal friend. Student's on average tended first to seek support from those close to them and then slowly branch out of their networks to less weak ties. By Person 2, network members were still *friends,* the second most common classification shifted to *casual friend*, except for Chinese females who had the same pattern as in Person 1, *friend* and *close personal friend*. By Person 3, *friends* were still the dominant classification, but there were also more of other types of closeness relationships in students' networks. All students had increased the number of *casual friends* and *acquaintances* in their networks from Person 1 to Person 4 indicating a shift outside close relationships to more distant connections for information and support. The percentages of network members who were classified as *acquaintances* and as *casual friends* were significantly different at Person 1 for Chinese and Indian females; in fact, they were the inverse of one another (see Table 19).

Country affected tie strength at Person 2 where more Indians had weaker ties than Chinese students. No significant differences were seen at further levels (Table 20) nor between groups (Table 21). Finally, differences in overall tie strength (the sum of closeness for all ego's network members) also showed no significant differences by main effects, sex and country (Table 22).

Family Relationship Status

For a significant majority of students, network members were non-relatives. The percentage began at just under 90% for Person 1 (see Table 23) and rose to 95% by Person 4.

Table 20

Differences in Closeness by Network Member

Person	Test Groups	N	df	χ^2
Person 1		208	1	.95
	All Groups	208	9	13.63
	Sex	208	3	2.17
	Country	208	3	7.22
Person 2		201	1	2.16
	All Groups	201	9	15.23
	Sex	201	3	5.34
	Country	201	3	9.71*
	Chinese male and Indian male	142	3	5.49
	Chinese female and Indian female	59	3	6.25
Person 3		170	1	1.34
	All Groups[a]	170	9	13.09
	Sex	170	3	2.84
	Country	170	3	6.04
Person 4		135	1	.25
	All Groups	135	9	9.20
	Sex	135	3	2.27
	Country	135	3	6.26

[a]significant % of cells have expected values less than 5.
*p < .05

Table 21

Effects of Closeness Within Group Across all Network Members

Group	Number of Network Members	*df*	χ^2
Chinese Male	113	9	13.20
Chinese Female	130	9	9.09
Indian Male	383	9	16.10
Indian Female	88	9	7.27

Table 22

Effects of Sex and Country of Origin on Closeness

Variable	Test Group	Type III SS	*df*	F
Overall Tie Strength				
	Sex	4.12	1	.58
	Country	14.13	1	1.98
	Sex*Country	4.30	1	.60

Table 23

Frequency and Percent Family Relationships by Network Member by Group

			Chinese				Indian			
	Total		Male		Female		Male		Female	
Family Relationship	N	%	N	%	N	%	N	%	N	%
Person 1 (N=208)										
Spouse/Partner	15	7	4	12	9	25	0		2	8
Another relative	9	4	2	6	0		4	3	3	13
Not a relative	184	89	27	82	27	75	111	97	19	79
Person 2 (N=201)										
Spouse/Partner	2	1	1	3	1	3	0		0	
Another relative	2	1	2	7	0		0		0	
Not a relative	197	98	27	90	34	97	112	100	24	100
Person 3 (N=170)										
Spouse/Partner	5	3	2	8	2	6	0		1	4
Another relative	4	2	1	4	1	3	1	1	1	4
Not a relative	161	95	23	88	29	91	88	99	21	92
Person 4 (N=135)										
Spouse/Partner	1	1	0		0		1	2	0	
Another relative	6	4	1	4	1	4	2	3	2	12
Not a relative	128	95	23	96	26	96	64	95	15	88

More Chinese students reported a spouse/partner in their social networks as Person 1 than did Indian students; however, more Indian females reported other family members in their social network than did other groups. Although the numbers were minimal, students continued to reach to family relationships for Persons 2, 3, and 4 for support.

Of those who had a family relationship as the first person in their networks, there were significantly more Indian females than Indian males and more Chinese males than Indian males (Table 24). Also, significantly more Chinese females had spouse/partner in their network than did Indian females. Significant differences appear at Person 2, however the high percentage of small cell sizes requires caution with interpretation (Table 24). Chinese females were significantly different from all other groups (Table 25) in the patterns of family relationships in their networks. They had 75% non-relatives as Person 1 which increased to over 90% at Persons 2 through 4. Differences between groups are likely attributable to the married/partnered status of students.

Student Status

Students demonstrated strong preference for seeking support from fellow students. For nearly 50% of the sample, the first person in their support network was a student in the same department (Table 26). Thereafter, the trend was to first seek support from students in the same department, and then increasingly from students in other departments, and then non-students.

A significant difference noted at Person 1 for differences in student status was not seen at less aggregate levels (Tables 27 and 28). Some tendencies in student's behavior with regards to student members in their networks were stronger than others. For example, for more Chinese

Table 24

Effects of Sex and Country of Origin on Family Relationships by Network Member

Person	Test Groups	N	*df*	χ^2
Person 1 (N=208)		208	1	5.52*
	All Groups[a]	208	6	32.90*
	Sex[a]	208	2	15.88*
	Chinese Male and Chinese Female	69	2	3.80
	Indian Male and Indian Female	139	2	13.43*
	Country[a]	208	2	21.06*
	Chinese Male and Indian Male	148	2	14.96*
	Chinese Female and Indian Female	60	2	6.71*
Person 2 (N=201)		201	1	3.91*
	All Groups	201	6	15.88*
	Sex[a]	201	2	1.24
	Chinese Male and Chinese Female	65	2	2.43
	Indian Male and Indian Female[b]	136		
	Country[a]	201	2	8.54*
	Chinese Male and Indian Male	142	2	11.44*
	Chinese Female and Indian Female[b]	59		
Person 3 (N=170)		170	1	2.49
	All Groups[a]	170	6	7.60
	Sex[a]	170	2	2.44
	Country[a]	170	2	5.37
Person 4 (N=135)		135	1	.68
	All Groups	135	6	3.51
	Sex	135	2	1.33
	Country	135	2	.67

[a]warning significant percentage of cells have expected counts less than 5.
[b]Row or column sum zero. No statistics computed.
*$p < .05$

Table 25

Effects of Family Relationship Within Group Across all Network Members

Group	Number of Ties	*df*	χ^2
Chinese Male	113	6	4.47
Chinese Female	130	6	17.70*
Indian Male	383	6	9.33
Indian Female	88	6	7.34

* $p < .05$

Table 26

Frequency and Percent Student Status by Network Member by Group

			Chinese				Indian			
	Total		Male		Female		Male		Female	
Student Status	N	%	N	%	N	%	N	%	N	%
Person 1(N=208)										
Student my same dept	102	49	21	64	17	47	51	44	13	54
Student another dept	51	25	7	21	6	17	31	27	7	29
Not a student	55	26	5	15	13	36	33	29	4	17
Person 2 (N=201)										
Student my same dept	82	41	15	50	16	46	39	35	12	50
Student another dept	53	26	8	27	7	20	34	30	4	17
Not a student	66	33	7	23	12	34	39	35	8	33
Person 3 (N=170)										
Student my same dept	64	38	11	42	7	22	37	42	9	39
Student another dept	57	34	10	38	12	37	27	30	8	35
Not a student	49	28	5	19	13	41	25	28	6	26
Person 4 (N=135)										
Student my same dept	44	33	9	38	8	30	24	36	3	18
Student another dept	39	29	10	42	5	18	16	24	8	47
Not a student	52	38	5	21	14	52	27	40	6	35

Table 27

Differences in Sex and Country of Origin on Student Status by Network Member

Person	Test Groups	*N*	*df*	χ^2
Person 1 (N=208)		208	2	23.20*
	All Groups	208	6	7.60
	Sex	208	2	.41
	Country	208	2	2.13
Person 2 (N=201)		201	2	6.30*
	All Groups	201	6	5.36
	Sex	201	2	2.83
	Country	201	2	1.89
Person 3 (N=170)		170	2	1.99
	All Groups	170	6	5.72
	Country	170	2	1.68
	Sex	170	2	2.70
Person 4 (N=135)		135	2	1.91
	All Groups	135	6	9.80
	Sex	135	2	1.98
	Country	135	2	.06

* p< .05

Table 28

Differences in Student Status Within Group Across all Network Members

Group	Number of Network Members	*df*	χ^2
Chinese Male	113	6	5.42
Chinese Female	130	6	9.40
Indian Male	383	6	4.96
Indian Female	88	6	8.55

males and Indian females, Person 1 was a *student in same department*. More Indian students than Chinese students had as Person 1 a *student in another department,* and for over a third of Chinese females and nearly a third of Indian males, Person 1 was someone other than a student.

For Chinese students the trend was first *student in same department* and then increasingly *student in other departmen*t. The second person in Chinese male's networks included more non-students. Chinese females began to increase the number of non-students by the third network person. Indian students tended first to seek students in same department and then students in other department.

Non-students were less visible in networks of Chinese males and Chinese females. Further, Chinese males consistently sought support from students more frequently than the other groups.

For all groups, except Chinese females, the tendency was to seek support from increasingly more non-students. Chinese females tended to have students as Person 2. The trend completely reversed itself for Person 3. Chinese females had more non-students in their networks and all other groups had fewer non-student support. At Person 4, all groups (38%) included non-students.

Language Ability

The English language ability of members of Chinese and Indian student's networks differed (Table 29) affected in large part by the English language abilities of many of the Indian

Table 29

Frequency and Percent English Language Ability by Network Member by Group

			Chinese				Indian			
	Total		Male		Female		Male		Female	
Network Member's English Language Ability	N	%	N	%	N	%	N	%	N	%
Person 1(N=208)										
Better than mine	63	58	19	58	18	50	22	19	4	17
Same as mine	129	39	13	39	15	42	82	71	19	79
Not as good as mine	16	8	1	3	3	8	11	10	1	4
Person 2 (N=200)										
Better than mine	69	35	12	40	19	54	32	29	6	25
Same as mine	114	57	15	50	14	40	69	62	16	67
Not as good as mine	17	8	3	10	2	6	10	9	2	8
Person 3 (N=169)										
Better than mine	54	32	11	44	20	62	19	21	4	17
Same as mine	101	59	13	52	12	38	59	66	17	74
Not as good as mine	14	9	1	4	0		11	13	2	9
Person 4 (N=134)										
Better than mine	45	34	7	29	17	65	19	28	2	12
Same as mine	67	50	13	54	6	23	38	57	10	59
Not as good as mine	22	16	4	17	3	12	10	15	5	29

students. The tendency for Chinese students was first to seek support from one with *better* English language ability, followed closely by *same*. This contrasted with the first person in the Indian student's networks where most had *same* English language ability and fewer than 20% had *better*. Significant differences between Chinese and Indian students likely were due to the English language skills of ego (see Table 30).

More (50%) of the second person in the networks of Chinese males had *same* English language ability and fewer (40%) had *better*. This pattern continues through the Chinese male's networks. At Person 3, however, Chinese males had an almost equal percentage of students of *better than* and *same as* English language ability which was significantly different from Indian students who tended to have fewer network members with English language ability better than their own.

Chinese females, however, consistently reported that network member's English language ability was *better* than their own. This tendency increased for network members 2, 3, and 4 becoming significant at Person 3 with Indian females and at Person 4 with Chinese males. In both cases, Chinese females had more network members whose English language ability was same and fewer whose language ability was better. The inverse was true of Indian females and Chinese males. Chi-square test conducted across all network members (Table 31) showed no significant differences between network members and their English language ability.

University Roles

More network members (33%) of Chinese females were university faculty and staff. This was true of 28% of Indian males, 22% of Chinese males, and 18% of Indian females. This is

Table 30

Effects of Sex and Country of Origin on Comparative English Language Ability by Network Member

Variable	Test Group	N	*df*	χ^2
Person 1 (N=208)		208	1	17.16*
	All Groups[a]	208	6	28.66*
	Sex	208	2	1.64
	Country	208	2	26.70*
	Chinese Male and Indian Male	148	2	19.10*
	Chinese Female and Indian Female	60	2	8.31*
Person 2 (N=200)		200	1	2.80
	All Groups[a]	200	6	9.28
	Sex	200	2	2.35
	Country	200	1	7.52*
	Chinese Male and Indian Male	141	2	1.56
	Chinese Female and Indian Female	59	2	5.02
Person 3 (N=169)		169	1	12.86*
	All Groups[a]	169	6	24.44
	Sex	169	2	6.28
	Country	169	2	21.61*
	Chinese Male and Indian Male	114	2	5.73
	Chinese Female and Indian Female	55	2	12.39*
Person 4 (N=134)		134	1	3.26
	All Groups	134	6	17.86*
	Sex	134	2	4.38
	Country	134	2	7.52*
	Chinese Male and Indian Male	91	2	.06
	Chinese Female and Indian Female	43	2	11.98*

[a]warning significant percentage of cells have expected counts less than 5.
* $p < .05$

Table 31

Effects of Comparative English Language Ability Within Group Across all Network Members

Group	No. of Network Members	*df*	χ^2
Chinese Male	112	6	7.41
Chinese Female	129	6	5.97
Indian Male	383	6	6.59
Indian Female	88	6	8.01

consistent with findings of the percentage of students present in these networks. The trend was consistent across all groups and remained constant for all network members (Table 32). Tests for independence (Tables 33 and 34) were conducted after combining responses due to small cell size. Three new categories were created: academic advisor, all other faculty, and no university role. Results showed significant differences between all groups at Persons 1 through 4, however these differences were not seen in the main effects, sex and country, at less aggregate levels. At Person 3, however, differences were seen between sex as significantly more Chinese females had network members who also had a role within the university.

Demographic Homogeneity

The student's network members were most homogeneous on country of origin (Table 35). Homogeneity was higher on sex for all males, for all their network members, than it was for females. Over half of males' network members were like them, and less than half of females' network members tended to be similar. Homogeneity was lower as male students reached to network members 2, 3, and 4 (Table 35); however, for the second person in both Chinese and Indian female's networks, homogeneity was higher and then followed a decreasing trend. Demographic homogeneity was highest for males (57%) and least high for Chinese females (40%). In particular, Chinese females had fewer network members of same sex and fewer of same country of origin.

Table 32

Frequency and Percent University Roles by Network Member by Group

			Chinese				Indian			
	Total		Male		Female		Male		Female	
University Role	N	%	N	%	N	%	N	%	N	%
Person 1(N=207)										
Academic Advisor	23	11	2	6	6	17	14	12	1	4
Faculty same dept.	5	2	1	3	3	8	1	1	0	
Faculty other dept.	2	1	1	3	0		1	1	0	
Staff same dept	10	5	1	3	1	3	8	7	0	
Staff other dept	10	5	1	3	2	5	7	6	0	
No Univ Role	157	76	27	82	24	67	83	73	23	96
Person 2 (N=201)										
Academic Advisor	26	13	3	10	6	17	15	13	2	8
Faculty same dept.	10	5	0		1	3	8	7	1	4
Faculty other dept.	2	1	1	3	0		1	1	0	
Staff same dept	12	6	3	10	2	6	4	4	3	13
Staff other dept	9	4	1	3	0	0	8	7	0	
No Univ Role	142	71	22	74	26	74	76	68	18	75
Person 3 (N=170)										
Academic Advisor	14	8	2	7	6	19	5	6	1	5
Faculty same dept.	8	5	0		1	3	6	7	1	5
Faculty other dept.	1	1	0		1	3	0		0	
Staff same dept	7	4	1	4	2	6	2	2	2	8
Staff other dept	14	8	3	12	2	6	8	9	1	4
No Univ Role	126	74	20	77	20	63	68	76	18	78

Table 32 (Continued)

Frequency and Percent University Roles by Network Member by Group

			Chinese				Indian			
			Male		Female		Male		Female	
University Role	N	%	N	%	N	%	N	%	N	%
Person 4 (N=134)										
Academic Advisor	8	6	1	4	2	7	3	5	2	12
Faculty same dept.	6	4	1	4	3	11	2	3	0	
Faculty other dept.	2	1	0		0		2	3	0	
Staff same dept	12	9	0		4	15	6	9	2	12
Staff other dept	10	7	3	13	1	4	6	9	0	
No Univ Role	96	72	19	79	17	63	47	71	13	76

Table 33

Effects of Sex and Country of Origin on University Roles (Combined) by Network Member

Person Test Groups	N	*df*	χ^2
Person 1	207	2	168.46*
All Groups[a]	207	6	8.72
Sex	207	2	.69
Country	207	2	.24
Person 2	184	2	72.79*
All Groups[a]	184	6	7.95
Sex	184	2	.30
Country	184	2	.13
Person 3	150	2	74.88*
All Groups[a]	150	6	14.81*
Sex	150	2	3.01
Country	170	2	4.78
Person 4	116	2	63.85*
All Groups[a]	116	6	5.65
Sex	116	2	1.34
Country	116	2	.45

[a]significant percentage of cells have expected counts less than 5

*$p < .05$

Table 34

Effects of University Roles (Combined) Within Group Across all Network Members

Group	Number of Network Members	*df*	χ^2
Chinese Male	113	15	10.95
Chinese Female	130	15	12.93
Indian Male	381	15	18.90
Indian Female	88	15	9.38

Table 35

Frequency and Percent Demographic Homogeneity by Parameter by Network Member

			Chinese				Indian			
	Total		Male		Female		Male		Female	
Demographic Attributes	N	%	N	%	N	%	N	%	N	%
Person 1 (N=208)										
Same sex	143	69	22	67	11	31	100	87	10	42
Same marital/partner status	98	47	12	36	17	47	62	54	7	29
Same country of origin	146	70	26	79	18	50	82	71	20	83
Same native language	85	41	20	61	18	50	38	33	9	38
Person 2 (N=201)										
Same sex	143	72	21	70	16	46	92	82	14	58
Same marital/partner status	84	42	11	37	7	20	56	50	10	42
Same country of origin	112	56	18	60	18	51	63	56	13	54
Same native language	75	38	16	53	17	49	36	32	6	25
Person 3 (N=170)										
Same sex	104	61	17	65	10	31	68	76	9	39
Same marital/partner status	76	45	8	31	9	28	50	56	9	39
Same country of origin	97	57	17	65	14	44	53	60	13	57
Same native language	69	41	14	54	13	41	33	37	9	39
Person 4 (N=135)										
Same sex	84	62	15	63	12	44	49	73	7	41
Same marital/partner status	58	43	7	29	6	22	36	54	8	47
Same country of origin	64	47	15	63	8	30	31	46	9	53
Same native language	45	33	15	63	7	26	15	22	7	41

Country homogeneity for Chinese students was consistently stronger for males than for females. Male Indian students tended to have significantly higher homogeneity in sex and marital/partnered status than did female Indian students.

Significantly more of the network members of Chinese students and Indian females spoke their same native language/mother tongue. Interestingly, the second person in student's networks tended to be more dissimilar than Person 1 on all parameters except sameness in sex. The trend reverses itself at Person 3 with the exception of sameness in sex, which reacts the opposite of the other parameters decreasing in sameness.

Significant differences (Table 36) were attributed to males having more homogeneous networks than females, males having more same sex members than females, Chinese males having higher homogeneity in their networks than other groups including those who speak same native language, and Chinese females having less homogeneity including country of origin.

Sex and country are significantly different on the parameter same sex. Marital/partnered status is significantly different by country and by native language/mother tongue. All groups are significantly different on sex and on marital/partnered status (Table 37).

Chinese students tended to be married and Indian students not; however, there are more married Indian females than Indian males. Also females tended to have male members in their networks and more males have same sex members. Finally, Indian students tended to have stronger English language ability than Chinese students enabling them to more easily associate with others not from their same country of origin.

By group (Table 38), homogeneity across all student's network members was not significantly different. In other words, the homogeneity of Person 1 was not significantly

Table 36

Effects of Sex and Country of Origin on Demographic Homogeneity by Network Member

Person	Test Groups	N	*df*	χ^2
Person 1				
	All Groups	208	12	31.12*
	Sex	208	4	14.58
	Country	208	4	4.61
Person 2				
	All Groups	201	12	12.79
	Sex	201	4	10.94*
	Chinese Male and Chinese Females	260	4	21.46*
	Indian Male and Indian Females	544	4	23.27*
	Country	201	4	1.66
Person 3				
	All Groups	170	12	16.36
	Sex	170	4	10.85*
	Chinese Male and Chinese Females	232	4	29.84*
	Indian Male and Indian Females	448	4	12.29*
	Country	170	4	7.06
Person 4				
	All Groups	135	12	19.02
	Sex	135	4	6.07
	Country	135	4	3.76

*p < .05

Table 37

Effects of Sex and Country of Origin on Parameters of Demographic Homogeneity

Parameters	Test Group	N	*df*	χ^2
Same Sex				
	Sex	135	4	45.53*
	Country	135	4	18.85*
	All Groups	135	12	54.60*
Same Marital/Partnered Status				
	Sex	135	4	7.50
	Country	135	4	15.98*
	All Groups	135	12	25.53*
Same Country of Origin				
	Sex	135	4	4.49
	Country	135	4	4.51
	All Groups	135	12	14.53
Same Native Language/Mother Tongue				
	Sex	135	4	2.06
	Country	135	4	10.96*
	All Groups	135	12	20.84*

* $p < .05$

Table 38

Effects of Parameters of Demographic Homogeneity by Group

Group	Parameters	N	*df*	χ^2
Chinese Male				
	Same sex	113	3	.35
	Same marital partner status	113	3	.54
	Same country of origin	113	3	3.00
	Same native language/mother tongue	113	3	.73
Chinese Female				
	Same sex	130	3	2.83
	Same marital partner status	130	3	7.58
	Same country of origin	130	3	3.54
	Same native language/mother tongue	130	3	4.44
Indian Male				
	Same sex	383	3	6.55
	Same marital partner status	383	3	8.09
	Same country of origin	383	3	12.02*
	Same native language/mother tongue	383	3	3.96
Indian Female				
	Same sex	88	3	2.24
	Same marital partner status	88	3	1.51
	Same country of origin	88	3	6.17
	Same native language/mother tongue	88	3	1.57

$p < .05$

different from that of Person 3 for all Chinese males for all network members. Only Indian males showed a significant differences and that was in country of origin. This is likely due to the argument posed above about the enabling effects of their stronger English language skills. Table 39 shows the average homogeneity (all parameters) by network member. Note that males have same demographic homogeneity on average across all network members (57%); that females have less especially Chinese females (40%). Homogeneity decreases from Persons 1 to Person 4 for males. But this is not true for females. At Person 2, homogeneity increases for females, especially Indian females (57%). At Person 3, homogeneity begins to decrease, however, Indian females again increases at Person 4.

Other Connections

Other ways in which students connected with their network members included roommate, study partner, lab partner, church member, host family member, member of a nationality-based listserv or a nationality-based association. Frequency and percent responses to these options by group are shown in Table 40.

Overall patterns were consistent from network member to network member across groups. For more than 60% of Chinese students and more than 50% of Indian students, Person 1 was a roommate, study partner, and/or lab partner although the percentages of each varied by group. For all network members, there were nearly an equal percentage of roommates as lab partners. For Chinese males, network members were most often lab partners than any other role.

Table 39

Average Percent Demographic Homogeneity by Network Member by Group

Group	Overall Average	Network Member			
		Person 1	Person 2	Person 3	Person 4
Chinese Male	57	61	57	54	54
Chinese Female	40	44	47	37	29
Indian Male	57	61	59	57	48
Indian Female	48	48	57	43	46

Table 40

Frequency and Percent Other Connections by Network Member by Group

			Chinese				Indian			
	Total		Male		Female		Male		Female	
Other Connections	N	%	N	%	N	%	N	%	N	%
Person 1 (N=208)										
Roommate	49	24	5	15	7	19	33	30	4	17
Study partner	23	11	6	18	7	19	8	7	2	8
Lab partner	47	23	10	30	10	28	20	18	7	29
Church/Host family	5	2	2	6	1	3	2	2	0	
Listserv/Assoc	76	37	11	33	14	39	40	35	11	46
Person 2 (N=201)										
Roommate	42	21	8	27	1	3	26	23	7	29
Study partner	25	12	7	23	4	11	10	9	4	17
Lab partner	36	18	9	30	8	23	13	12	6	25
Church/Host family	7	3	1	3	4	11	2	21	0	
Listserv/Assoc	63	31	9	30	14	40	33	30	7	29
Person 3 (N=170)										
Roommate	31	16	3	12	4	13	19	21	5	22
Study partner	20	12	4	15	1	3	14	16	1	4
Lab partner	26	14	9	35	3	9	12	13	2	9
Church/Host family	6	4	1	4	2	6	3	3	0	
Listserv/Assoc	47	28	8	31	11	34	24	27	4	17
Person 4 (N=135)										
Roommate	18	13	2	8	1	4	12	18	3	18
Study partner	13	10	6	25	3	11	4	6	0	
Lab partner	27	20	7	30	3	11	12	18	5	29
Church/Host family	5	4	1	4	2	5	2	3	0	
Listserv/Assoc	26	19	11	46	5	19	9	13	1	6

Note: Percents will not sum to 100. Students were to indicate all that apply.

For Chinese females that was true 75% of the time. Network members of Indian males tended first to be roommates and secondly to be lab partners. The inverse is true of Indian females.

Tests of independence used a variable which combined roommates, study partners and lab partners, the top choices of the students (Table 41). Other responses were eliminated from the test because of small cell sizes. The new variable highlighted significant differences in country at Persons 1, 2, and 3, for these three roles. Indian students tended to have roommates as network members and Chinese students tended to have lab partners.

Host families and church relations had little role in these support networks. Less than 4% of the sample indicated having connected with any of their network members through either of these means. Approximately 30% of network members were members of a nationality based listserv and/or association.

Ego to Network Member Relationships

Data were also collected on the relationships among network members to understand network density and network solidarity. Density measures the connections among network members without regard to strength of those connections; solidarity measures those connections and considers strength of the connections.

On average, density and solidarity were the same for both countries. However, the networks of Chinese males showed higher average density and higher average solidarity than all other groups (Table 42) meaning in the networks of Chinese males, more network members knew one another and more were closer than in networks of the other groups. Females tended to have less dense networks indicating some individuals (nearly 40%) do not know one another.

Table 41

Effects of Sex and Country of Origin on Roommate, Study Partner, and Lab Partner by Network Member

Variable	Test Group	N	*df*	χ^2
Roommate, Study Partner, Lab Partner Person 1				
	Sex	186	1	.52
	Country	186	1	15.01*
	All Groups	186	1	14.94*
Roommate, Study Partner, Lab Partner Person 2				
	Sex	193	1	1.75
	Country	193	1	4.44*
	All Groups	193	1	1.75
Roommate, Study Partner, Lab Partner Person 3				
	Sex	161	1	1.45
	Country	161	1	6.02*
	All Groups	161	1	10.15*
Roommate, Study Partner, Lab Partner Person 4				
	Sex	128	1	.04
	Country	128	1	.29
	All Groups	128	1	.22

*$p < .05$

Table 42

Mean Percent Density, Solidarity, and Structural Holes by Group

Group	Density	Solidarity	Structural Holes
Chinese Male	70	45	10
Chinese Female	61	31	10
Indian Male	65	40	9
Indian Female	60	35	11
Chinese Students	65	38	10
Indian Students	64	39	9
Male Students	66	41	9
Female Students	60	33	10

Further, a smaller percentage of the network members of females were connected by strong ties (solidarity) than were networks of males.

Structural holes, too, were similar across all groups. Structural holes were measured as the percent of ties for which ego responded (a) network members did not know one another plus (b) ego did not know whether or not network members knew one another.

Tests on the differences sex and country have on density, solidarity, and structural holes showed that sex was significantly different on the variable solidarity (Table 43). Females tended to have less solidarity in their networks than males.

Analyzing Research Questions

Research Question 1

One of the objectives of this research was to learn about the attributes of Chinese and Indian student's networks as they relate to their progression through the university system. The social networks of Chinese and Indian graduate students averaged about 6.1 members although that varied by group. Chinese students tended to have larger networks (7 members) than Indian students (6 members). The networks had an average density of between 60% and 70% with solidarity of between 30% and 45%. Chinese males were most connected, females least.

Most network members were friends of ego and most were students. Friends comprised over 50% of Chinese male's networks and over 40% of Chinese female's and Indian male's networks. Slightly under 40% of Indian female's network members were friends. Approximately 20% of all network members were close personal friends although it was slightly higher for

Table 43

Effects of Sex and Country of Origin on Connectedness

Connectedness Variable	Test group	Type III SS	*df*	F
Density				
	Sex	1756.57	1	1.43
	Country	375.26	1	.30
	Sex * Country	144.92	1	.12
Solidarity				
	Sex	3113.99	1	4.66*
	Country	43.37	1	.06
	Sex * Country	681.78	1	1.03
Structural Holes				
	Sex [a]	7.35	1	1.92
	Country [a]	.99	1	.99
	Sex * Country	11.92	3	.98

[a] warning significant percentage of cells have expected counts less than 5
*$p < .05$

Chinese females. Casual friends and acquaintances comprised less than a third of Chinese student's network members as compared with approximately 40% of Indian student's networks.

Eighty percent of Chinese male's network members were students. Fewer of Chinese female's (60%) network members were students. Indian students fell between these two points as 70% of their network members consisted of students.

For over two-thirds of Indian students, the English language ability of their network members was the same as their own. The English language ability of members of Chinese male's networks was split nearly evenly (43% and 48%) between members with better ability and those with same ability. Significantly more members of Chinese female's networks had English language ability that was better than ego; just over one third had English language ability, which was the same.

An overwhelming majority of the network members were not family members. A full 85% of network members were not associated with the university in an official capacity as an advisor, university faculty, or university staff role. However, Chinese females consistently had advisors as network members more so than other groups (15% for Chinese females, 10% for Indian males and 7% for both Chinese males and Indian females). Presence of faculty as a network member was considerably less at less than 7% for each group.

For most of the males (81% Indian and 66% Chinese), the network member was of the same sex. Sixty-two percent of Chinese females and 55% of Indian females had male members in their networks.

Over half of the Indian male network members were of same marital/partnered status; that is to say, not married/partnered. Between 30% and 40% of the network members of the remaining groups were of the same marital/partnered status.

Except for 45% of Chinese female's networks, most (over 60%) of other group's network members were of same country of origin. Over half of Chinese male's network members spoke the same native language/mother tongue. This was true of the network members of only one third of Indian student's and slightly over 40% of Chinese female's network members.

In addition to being friends and students, network members were also roommates, study partners, and lab partners. Twenty-two percent of network members of Chinese males were roommates, study partners, or lab partners. This was true of 13% of Chinese female's network members, and 16% and 18%, respectively, of Indian male and female student's network members.

In summary, the networks tended to vary in size with Indian males having fewer members on average than all other groups. Density, solidarity, and demographic homogeneity (Table 44) were strongest for male's networks. Network size was larger for Chinese than Indian students.

Research Questions 2 and 3

In addition to understanding attributes of ego and his or her network members, and understanding the strength of interrelationships among network members (density and solidarity), I was also interested in two additional aspects of the student's networks: satisfaction and effectiveness. Satisfaction was a measure of adequacy of network size (research question 2). Effectiveness was a measure of the ability of the network to facilitate the student's academic goals (research question 3).

Table 44

Comparison of Structural Attributes of Student's Networks by Group

	Chinese		Indian	
Structural Attributes	Male	Female	Male	Female
Percent Average Density	70%	61%	65%	60%
Percent Average Solidarity	45%	31%	40%	35%
Percent Average Demographic Homogeneity	57%	40%	57%	48%
Percent Average Structural Holes	10%	10%	9%	11%
Weighted Average Network Size	7.2	6.7	5.6	5.5

The analyses required to answer the two research questions was similar. Contingency tables, chi-square analyses, ANOVAs, and logistic regressions that were fed by significant results from the previous chi-square analyses plus structural variables (size, solidarity, density, and demographic homogeneity). The logistic regression for satisfaction tested that students had sufficient persons in their networks. Another for effectiveness tested that the network enabled academic progression. In the tables that follow results of both dependent variables are presented together.

Results for Network Satisfaction and Effectiveness

Network Satisfaction

Satisfaction with size of the network is a proxy for overall satisfaction of the student's network. It was assumed that if students indicated they had sufficient people in their networks (it was of sufficient size), they were satisfied with their networks.

Over half (53%) of respondents indicated they would like a larger network (Table 45). This includes a significant percentage of Chinese students (85% males and 64% females). This overall average is somewhat misleading as over half of Indian students indicated the size of their network was adequate to meet the support needs identified despite the variability in network sizes for Indian males as compared with the other groups. No significant differences were seen between groups for satisfaction (Table 46); however, effects of country (Table 47) were significant highlighting the desire for Chinese males to have larger networks than Indian males.

Table 45

Percent Finding Network Size Sufficient and Percent Enabled by their Networks by Group

		Chinese		Indian	
Dependent Variables	Total	Male	Female	Male	Female
Network Satisfaction					
Network size was **sufficient**	47	15	36	57	58
Want **more** people in their support network	53	85	64	43	42
Network Effectiveness					
Network **enables** academic progression	83	82	92	82	80
Network had no effect or was a barrier	17	18	8	18	20

Table 46

Sample Group Differences in Network Satisfaction and Effectiveness

Dependent Variable	N	*df*	χ^2
Network Satisfaction (N=207)	208	1	1.92
Network Effectiveness (N=208)	208	1	91.56*

*$p < .05$

Table 47

Effects of Sex and Country of Origin on Network Satisfaction and Effectiveness

Dependent Variable	Test Group	Type III SS	*df*	F
Network Satisfaction (N=208) (Enough Members)				
	Sex	.21	1	.94
	Country	2.73	1	11.86*
	All Groups	.65	1	2.84
Network Effectiveness (N=208) (Enabled)				
	Sex	.04	1	.35
	Country	.15	1	1.03
	All Groups	.14	1	1.01

*$p < .05$

Network Effectiveness

Overwhelmingly (84%), of the sample stated their networks enabled their academic progression (see Table 46). Chi-square tests for independence (see Table 46) found significant differences in effectiveness attributed to the significantly higher rate of effectiveness for Chinese females (92%). Percent effectiveness of Chinese males and Indian students is virtually the same (80%). Neither sex nor country of origin were significantly associated with effectiveness (see Table 47).

Interrelationships Between Satisfaction and Effectiveness

I was also interested in knowing how satisfaction and effectiveness were interrelated. Table 48 presents the mix of responses to the dependent variables. Note that while Chinese males indicated their networks were effective, they still wanted more members in their networks. This behavior supports claims of network theorists who state that unique information and resources come through weaker links and less homogeneous others. The high homogeneity of Chinese male networks may be helpful for some types of support needs and clearly is also helpful (satisfaction = 82%) for the type of support addressed in this research; however, the desire for more people in their networks indicates support needs remain.

Indian females were nearly evenly split between wanting a larger network and already having one of sufficient size, although nearly all indicated their networks were effective. Alternatively, nearly half of Indian males as compared with one third of Chinese females indicated that the network was effective and the size sufficient. Over 10% of Indian females and Chinese males indicated that their networks were not effective and they wanted a larger network.

Table 48

Percent Network Effectiveness and Satisfaction with Size by Group

	Chinese		Indian	
Effectiveness and Satisfaction of Networks	Male	Female	Male	Female
Network not effective and want a larger network	12	6	8	14
Network not effective but the size was ok	6	3	8	9
Network was effective but want a larger network	73	58	35	32
Network was effective and the size was ok	9	33	49	45

I used stepwise logistic regression to examine the effects of the structural variables and additional independent variables on the two dependent variables (satisfaction with network size and effectiveness. Also, I retained variables country and sex at each iteration regardless of significance. This was done because these variables are integral to the study and it enables comparison against results of previous tests.

Models were designed based on the variables that were significant from the studies of ego attributes, network member attributes, and the interactions of the network members. Model 1 included variables that were significant attributes of ego. These included country, family relationship, English, network size, marital/partnered status, time at the university, employment status at university, and tie strength Person 1. Model 2 included variables significant from the study of attributes of network members. These included tie strength of Person 2, English language ability of Persons 1 and 3, family relationship status of Person 1 and 2, university role of Person 3, and demographic homogeneity of Person 2 and 3. Model 3 included variables related to the interaction of network members such as solidarity, same marital/partnered status of Person 1, and same sex status of Persons 1 and 2.

All variables were included in iterations of the model. Non-significant variables were removed for the second iteration and the model rerun. A final model examined effects of density, solidarity, and network size each of which were entered into a logistic regression model.

Stepwise logistic regression results are shown in Table 49. All variables that previously showed significance by sex or by country were tested against the two dependent variables, satisfaction with network size and network effectiveness. Except for the reporting of sex and country, only significant results are reported.

Table 49

Effects of Variables on Network Satisfaction and Effectiveness

Variables						
Dependent	Independent	Estimate	Stand. Err.	Wald χ^2	*df*	Odds Ratio Est.
Model 1 – Ego variables						
Satisfaction with Network Size						
	Country	1.29	.35	13.31*	1	3.63
	Sex	.25	.36	.48	1	1.28
Effectiveness of Network to Enable Academic Progression						
	Country	-.27	.47	.33	1	.76
	Sex	.28	.49	.33	1	1.32
	Tie strength Person 1	.56	.19	8.71*	1	1.75
Model 2 – Network Member variables						
Satisfaction with Network Size						
	Country	1.34	.35	14.55*	1	3.83
	Sex	.31	.35	.75	1	1.36
Effectiveness of Network to Enable Academic Progression						
	Country	-.43	.46	.86	1	.65
	Gender	.32	.48	.46	1	1.38
	Demogr. Homogeneity P3	.53	.16	11.36*	1	1.71
Model 3 – Interaction Variables						
Satisfaction with Network Size						
	Country	1.37	.36	14.32*	1	3.94
	Sex	.33	.36	.85	1	1.39
Effectiveness of Network to Enable Academic Progression						
	Country	-.43	.45	.91	1	.65
	Sex	.37	.46	.62	1	1.44
	Marital/Partnered Status P1	1.19	.42	7.98*	1	3.29
Model 4 – Network Structure Variables						
Satisfaction with Network Size						
	Country	1.34	.35	14.56*	1	3.82
	Sex	.31	.35	.75	1	1.4
Effectiveness of Network to Enable Academic Progression						
	Country	-.30	.48	.38	1	.74
	Sex	.38	.50	.58	1	1.46
	Tie strength P1	.50	.19	6.60*	1	1.65
	Demogr homogeneity P3	.50	.16	9.81*	1	1.65

*$p < .05$

Results indicate that Indian students are nearly four times more likely to be satisfied with their networks than Chinese students. No other variable was significant for satisfaction. Decreasing tie strength of Person 1 (towards casual friend and acquaintance) was nearly two times more likely to be associated with enabling the network. This supports the weak tie theory which states that through weak ties one is more likely to obtain unique information. Demographic homogeneity of Person 3 was nearly two times more likely to find their network enabling.

Variables homogeneity and density are highly interrelated. Individuals tend to associate with similar others. Density indicates people know one another increasing the likelihood that they are also similar, affecting homogeneity. Homogeneity, density, and solidarity are typically associated with some types of strong support networks. However, networks created to access unique information are typically less effective if they are homogeneous and dense because the information accessed through these close ties is redundant. For the type of support addressed by this study, homogeneity, density, and solidarity should be negatively associated with effectiveness. As proof, Chinese females have the least homogeneous networks and they rated their networks more effective than all other groups. In general, however, density and solidarity were not associated with enabling academic progression nor were they related to satisfaction with network size.

In summary, Indian students were largely satisfied with the size of their networks (on average, 5.6 and 5.5 members for Indian males and Indian females, respectively) and Chinese students tended to want larger networks (on average, 7.2 and 6.7 members for Chinese males and

Chinese females, respectively). However, as a group, over half of all of these students wanted more members in their networks. No other variables were found to affect satisfaction.

Overwhelmingly, 84% were enabled towards academic progression through their networks. Further, 73% of Chinese males and 58% of Chinese females indicated their networks were effective but that they also wanted larger networks. Nearly 50% of Indian females too indicated that the network was effective, but that they also would like larger networks. Only 35% of Indian males indicated they wanted a larger network after indicating the network was effective.

Research Question 4

This question asked about the structural variables (network size, homogeneity, density, and solidarity) and their effects on the two dependent variables. The networks differ on some variables and are similar on others. Chinese had larger networks than Indian students and Chinese males had more than all other groups. Indian female had the smallest networks at 5.5 people. Homogeneity was similar for males and lower for females. Chinese females had less homogeneity than Indian females. Density was strongest for Chinese males and next strongest for Indian males. Indian females and Chinese females were similar on density. Solidarity, too, was strongest for Chinese males and then for Indian males. Unlike density, solidarity, was stronger for Indian females than for Chinese females. These variables (Table 50) were tested for effects on the two dependent variables, satisfaction with network size and enabling effects of the network toward academic progression.

Satisfaction with network size was greatest for Indian students and significantly less for Chinese students. Only 15% of Chinese males believed their networks were of sufficient size. An

Table 50

Comparison of Network Structure Variables, Network Satisfaction, and Effectiveness by Group

Group	Weighted Avg. Network Size	Avg. Homogeneity	Avg. Density	Avg. Percent Solidarity	Network Satisfaction (Size = Sufficient)	Network Enables Acad. Progression
Chinese						
Males	7.2	57%	70%	45%	15%	82%
Females	6.7	40%	61%	31%	36%	92%
Indian						
Males	5.6	57%	65%	39%	57%	82%
Females	5.5	48%	60%	35%	58%	80%

overwhelming majority of the sample indicated their networks enabled academic progression; this despite a desire for more network members and differing network sizes.

The networks of these students are mostly homogeneous with regards to country of origin and sex. Homogeneity in general was lower as the number of network members increased (see Table 51). This happened between Persons 1 and 2 and then homogeneity was higher again before it decreased for male network members. Overall homogeneity averaged 57% at Person 1 and 46% at Person 4. This reflects a progressive trend to non-similar others in the networks.

In general, ties tended first to be friends throughout and then at successive network members expanded as a second choice to less close others. Table 52 shows a progression by group from Person 1 to Person 4 of the percent of weak links identified by the sample. Weak links become more visible as more people enter the networks and as students continue to tap friends in their network for the support covered by this study. Ultimately, a shift towards less close others was seen.

Summary of Students' Networks by Group

Chinese Males

Over 50% of Chinese males tended to have networks of friends who were like them in sex, country of origin, and native language. About one-third were of same marital/partnered status. Six percent were spouses/partners and 20% were close personal friends. Seventy percent of Chinese male network members knew one another (density) and 45% were especially close (solidarity). For most (80%), the network member was a student. The English language ability of the first person tended to be better than their own and for all other network members was the same.

Table 51

Percent Homogeneity of Network Members by Group

Network Member	Overall Average	Chinese		Indian	
		Male	Female	Male	Female
Person 1	57	61	44	61	48
Person 2	51	50	41	55	45
Person 3	51	54	36	57	43
Person 4	46	54	31	49	46

Table 52

Percent Weak Links Among Network Members by Group

	Chinese		Indian	
Network Member	Male	Female	Male	Female
Person 1	6	22	12	4
Person 2	7	17	17	17
Person 3	12	31	19	22
Person 4	21	41	24	24

On average, 30% of Chinese male's network members were same lab partner, 20% were study partners, and 15% were roommates.

Average density, homogeneity, solidarity, and network size are highest for Chinese males. This group is least satisfied with their network size (15%); although, 82% agreed that their networks enabled academic progression.

Chinese Females

For roughly one-half of Chinese females, the first two people in their networks had the same country of origin and same native language, less than half were of same marital/partner status, and less than one third were of same sex. As the Chinese female reached to network members 2, 3, and 4, homogeneity decreased. Over 40% of her network members were friends, another 25% and 27%, respectively, were acquaintances or close personal friends, and a few were casual friends. Approximately 60% knew one another and a third were especially close. Sixty percent of Chinese female's network members were students. Thirty-three percent of their network members (the highest of all groups) were affiliated with the university in an official advisor, faculty, or staff role. On average, network members were roommates or study partners or lab partners just under 20% of the time. Over one third were non-students and that percentage increased as the Chinese female reached to subsequent network members.

Chinese females tended to have more weak links than all other groups and a result, their networks also tended by be less homogeneous than other groups. Homogeneity was lower and average network size was higher than for Indian females. Average density (61%) and solidarity (31%) were similar with that of Indian students. This group, like Chinese males, was less satisfied (36%) with the size of their networks. However, more so than any other group, Chinese females (92%) found their networks effective.

Indian Males

The networks of Indian males were generally smaller than all other groups (up to three members). Over half of network members were similar, 60% knew one another, and nearly 40% were especially close. Network members were friends (41%) who were of the same sex, same marital status, and same country of origin. Most network members were students from the same department (40%) or other department (28%), and 30% of network members were roommates. Only one third spoke the same native language. Twenty-eight percent had a university-related role. English language ability of the network members (65%) was about the same as that of the Indian males.

Over half of Indian male network members were like them. Networks were fairly dense (65%) and solidarity at 39% was similar to that of Indian females. Over half (57%) were satisfied with their network size and most (82%) found their networks effective.

Indian Females

Over 35% of Indian females had friends as their network members and over 25% had casual friends as their network members. Sixty percent of the network members knew one another and over a third had close relationships. As seen with all other groups, most network members were not family members; although, some Indian females resided with family or spouse/partner. Over 40% of network members were students in same department and another 31% were students in another department. Over 25% were not students, yet, only 18% had an official university role as advisor, faculty, or university staff. This was less than all other groups. About 70% of Indian females network members spoke English at the same level as the Indian females.

Overall, Indian students were more satisfied with their networks than Chinese students, and Indian females slightly more than Indian males (58% and 57%, respectively). Less than half of Indian female's network members were like them. Indian females were satisfied with the size of their networks, more so than any other group, and over three fourths (80% agreed their network was effective.

Network Connectedness

The number of weak links was significantly different at Person 1 for Chinese females. That group more than any other exhibited behavior associated with gaining access to unique information; that is non-homogeneous networks. Other groups stayed within their homogeneous environments and only at subsequent network members was there evidence of decreased connectedness among network members. Chinese males' networks tended to remain homogeneous and dense with few weak links. Indian students were similar in their patterns of weak links. Average homogeneity was highest for males and least for females. Density was high for males but highest for Chinese males (70%). Solidarity was again, high for males (45% and 39%, Chinese and Indian males, respectively). Solidarity was least for Chinese females and highest for Chinese males. An overwhelming percentage of students found their networks enabling and effective. Indian females were least at 80% and Chinese females highest at 92%.

CHAPTER FIVE

Chinese and Indian students represent the largest international student populations worldwide and the largest number of international students in the U.S. (Institute for International Education, 2001; McMurtrie, 2001). Upon arrival at their higher education institutions, international students are forced to create social networks anew (Tanaka et al., 1997). The goal of this research was to understand the construction of those social networks and ascertain how they influenced academic progression.

Support related to making one's way through the university system and rules and regulations associated with living in the host community framed the social networks. Chinese and Indian students and university staff who provide support to the international students identified the specific needs which collectively provided the frame or the structure of social support, thus defining the social networks for this study. Examples of needs covered by this support system include preparing a plan of study, completing required paperwork, and obtaining a driver's license. Each requires instrumental action on the part of the student.

I applied constructs of social network theory to the design, conduct, and analysis of the study of the student's support networks. I also designed a Web-based survey instrument with input from the Chinese and Indian students. The surveys provided data regarding the social networks of these groups.

Data were collected on ego, network members, tie strength between ego and network member and among network members, and on satisfaction with the network and effectiveness of the network to enable academic progression. Ego data included demographic data (sex, country

of origin, age, marital/partnered status), length of time at the university, university employment status, with whom students resided, and membership in a nationality-based listerv. Network member attributes included tie strength with ego and tie strength with other network members, university roles, family relationship with student, English language ability, and demographic homogeneity measured across four parameters: sameness in sex, marital/partnered status, country of origin, and native language. Ego and network member data were tested for group differences using chi-square analyses and analysis of variance. Tie strength among network members was used to measure density and solidarity.

Satisfaction with network size was used as a proxy for overall network satisfaction. Effectiveness measured the enabling effects of the network to achieve academic goals. Logistic regression was applied to these two dependent variables to understand the effects of the independent variables of ego and network member relationships as well as structural variables.

Data were captured and analyzed to answer four research questions:

1. *What are the characteristics of university system support networks of Chinese and Indian graduate students? Who provides support? What are the attributes of the providers?*
2. *What are the structural attributes of the support networks? How does the structure of the network affect the provision of support?*
3. *What is the effect of network structure on academic goals? How does the support network influence the achievement of academic goals?*
4. *How are the networks of Chinese and Indian graduate students similar and how do they differ in terms of size, homogeneity, solidarity, and density? What are the implications for satisfaction and effectiveness? Do social network theories related to*

variables at the structural level (homogeneity, density, solidarity) and relational level (closeness) hold true for the support networks of the Chinese and Indian graduate student populations?

Question 1 asks about the characteristics of the student's networks and provider attributes; questions 2, 3, and 4 used the structural variables (size, density, homogeneity, and solidarity) to address satisfaction with network size and its ability to address the support needs, effectiveness of the network to enable academic progression, and to discuss theoretical claims of these structural attributes. Data were analyzed by group (Chinese males, Chinese females, Indian males and Indian females).

Findings

It is through weaker links that unique information and resources are accessed and secured. The instrumental nature of the support in this study suggests efficacy in building non-homogeneous, non-dense networks of weak ties.

Findings significant to the study are presented below. Discussions follow within the context of two social network constructs (the networks and network structure) and include findings from this study and the literature. A list of major findings appears below.

Major Findings

1. Network members were predominately friends (a measure of tie strength) for all students. Network members were also predominately fellow students.
2. The networks were dense and homogeneous; female's networks were less dense and less homogeneous than male's.

3. Chinese males had the largest network size; Indian males had smallest network size.
4. Homogeneity was highest on country of origin over all students; for males, homogeneity was highest on sex.
5. Academic advisors were more visible in networks of Chinese females than in any other group. They were least visible in the networks of Indian females.
6. Weak links were more visible in networks of Chinese females and were also present in Indian students' networks.
7. Chinese females tended to have network members whose English language ability was better than their own. This was not the case for Chinese males, who tended to have network members whose ability was the same.
8. Students overwhelmingly reported that their networks enabled academic progression.
9. Over half of Indian students were satisfied with their networks; Chinese students were not.

Characteristics of Students' Networks

Networks of international students tend to consist mostly of friends and co-nationals (Bochner et al., 1977; Furnham & Bochner, 1982; Klineberg, 1982; Klineberg & Hull, 1979; Tanaka et al., 1994; Ward, Bochner, & Furnham, 2001). Based on the literature review and the nature of the support needs in my study, I expected the presence of university faculty or staff. Previous research (Eland, 2001; Maundeni, 2001) has found that advisors played a significant role in acclimating students to the new educational setting and have been critical to academic success.

Strong ties tend to reflect similarity in attributes, background, and experiences (Feld, 1982; Granovetter, 1973; Lin, 1982). Given the nature of the support needs, and their uniqueness to the higher education institution, I expected weak links (Granovetter, 1973) which are used to gather unique information (Friedkin, 1978; Granovetter, 1978, 1982; Lin, 1982; Lin, Ensel, Vaughn, 1981).

The findings confirmed previous studies on international students. Chinese and Indian students' networks consisted primarily of friends, and most of these friends were students. In the case of Indian students network members were also roommates, and in the case of Chinese students they were also lab partners.

University faculty and staff were visible at varying degrees in the students' networks, including 28% of Indian males' and 22% of Chinese males' network members. This was true of only 18% of Indian female network members, but 33% of Chinese female network members. Academic advisors were more prevalent in the networks of Chinese females (15%) than in other groups (10% of Indian males' networks, and 7% of Chinese male and Indian females' networks).

Weaker links (acquaintances and casual friends) connected 25% of Chinese females and Indian females to their first-named network person. This was also the case with 28% of Indian males but only 12% of Chinese males' networks.

Also, more than any other group, the network members of 57% of Chinese females tended to have English language skills better than hers. This contrasts with less than half of Chinese males' network members.

These findings suggest that for the type of social support addressed by this study, Chinese females have more efficient networks than the other groups. They have more university faculty and staff including academic advisors, more weaker links, and more individuals with better

English language skills in their networks. Their networks are designed to access non-redundant information and resources more so than other groups, especially those of Chinese males.

Network Structure

Structurally, I expected the networks of international students to be dense and homogeneous. Structural attributes of a network include size, density, homogeneity, and solidarity. Network size has both positive and negative connotations. Large networks can be advantageous for obtaining a variety of resources and support (Garton et al., 1997; Stokes, 1983); however, the effort required to maintain them can also be a substantial negative factor (Stokes, 1983). On the other hand, small networks limit knowledge of the environment and make it difficult to form alliances (Ibarra, 1993A).

International students characteristically have dense, homogeneous networks composed mostly of co-nationals (Bochner et al., 1977; Heikinheimo et al., 1986; Tanaka et al., 1994). Frequent interaction, strong ties, density, and solidarity are indicative of the presence of convenient and strong support mechanisms (Hurlbert et al., 2000). Dense networks, while they conduct redundant information and affect support and satisfaction, are of considerable value in times of need and crisis. They are, however, less effective when the purpose of the network is to access unique information such as navigating a new system. Larger, more heterogeneous and diverse networks infer greater access to unique information and are associated with information seeking (Garton et al., 1997; Granovetter, 1973; Hurlbert et al., 2000 Lin et al., 1981; Marsden, 1987).

I found network size to be larger for Chinese students than for Indian students. Chinese males had the largest networks with an average of 7 members. Chinese females averaged 6 members and Indian students averaged 5 network members.

As indicated by the literature, these students had dense, homogeneous networks. Homogeneity, density, and solidarity were somewhat higher for males, but the differences were not statistically significant. Homogeneity ranged from 40% to 57%, with Chinese females having the least and Chinese and Indian males having the most. Average density ranged from 60% to 70% for network members, with Indian females having the least and Chinese males having the most. Solidarity ranged from 31% to 45%, with Chinese females having the lowest and Chinese males having the highest.

Chinese males, in summary, had the highest network size, the most homogeneous and dense networks, along with the greatest solidarity. Chinese females had the least solidarity and the least homogeneity. Indian females and Chinese females had the least (and similar) average density (60% and 61%, respectively).

These structural attributes have implications for effectiveness and satisfaction. Effectiveness and satisfaction were the dependent variables in this study.

Effectiveness. The primary dependent variable was effectiveness – a measure of the enabling effects of the network to facilitate academic progression. Academic achievement is an international student's primary objective (Heikinheimo et al., 1986; Zimmermann, 1995) and forming social networks that facilitate that goal are critical. Others (Hayes et al., 1994; Jou et al., 1994; Heikinheimo et al., 1986; Zimmermann, 1995) found that students who established a social support environment, including a social network to facilitate social contact and social assistance, were more likely to achieve their goals.

Overall, 83% of the students in this study, and 92% of Chinese females, found their networks effective despite differences in density, homogeneity, and solidarity between male and female students, and network size between Chinese and Indian students. Attributes specific to the

Chinese females' networks which may have positively influenced this response included percent of network members who have a university role, the number of acquaintances at an early iteration, and the higher percentage of network members who possess better English language ability. Through their weaker links Chinese females created a productive, non-homogeneous network linking them to alternative sources of information and resources.

Satisfaction. Satisfaction refers to the measure of overall satisfaction with the student's network using as a proxy agreement that there were sufficient people in the student's networks to meet the student's needs. Studies on satisfaction have tended to focus on sojourn satisfaction. Satisfaction has been linked to association with hosts in networks (Tanaka et al., 1994; Bochner et al., 1977) and more students in the networks (Klineberg et al., 1979; Surdam et al., 1984; Tanaka et al., 1994; Ward et al., 2001; Westwood et al., 1990; Zimmermann, 1995).

Over half of the Indian students (57% male and 58% female) were satisfied that the size of their networks was sufficient to meet their needs; thus they were mostly satisfied with their networks. Only 15% of Chinese males and 36% of Chinese females indicated their networks were of a sufficient size despite their average sizes being larger than the networks of Indian students.

Satisfaction was highest for Indian students (who had smaller networks) and lowest for Chinese males. Largest network size, high homogeneity, and high density appear to have created insular networks for the Chinese males and negatively affected the support needs of Chinese males. The network members all know one another and share the same information. With few links to other's networks through weak links, for example, new information is not forthcoming. This supports claims of redundancy in dense, homogeneous networks and explains why Chinese males needed larger networks.

Structural variables (density, solidarity, and homogeneity) and connectedness (tie strength) showed no statistically significant effect on satisfaction with the size of the student's networks.

Theoretical Points Associated with Structural Variables

As shown in the literature (Bochner et al., 1977; Heikinheimo et al., 1986; Tanaka et al., 1994), students' networks were fairly dense and homogeneous. Unlike the literature, however, females' networks were less dense and less homogeneous than male's networks. Overall, homogeneity across all networks members was the same for males (56%) and less for Chinese females (39%) than for Indian females (45%).

Chinese females did not behave the same as Chinese males. In some instances, Chinese females behaved more like Indian students and all behaved differently than Chinese males. Their networks all had weaker links than those of Chinese males.

Chinese females had least homogeneity in their networks (40%). They had fewer same sex members and fewer from the same country of origin. Homogeneity across network members was highest on country of origin. Also, for all males, homogeneity was higher on sex. The limited number of female students in the population from whom the Chinese and Indian females might link is an enabling factor that decreased homogeneity in their networks.

Conclusions

The international student population is expected to continue to increase. Worldwide competition for these students is also expected to increase. These students have a variety of

different needs related to their sojourn including learning the culture and language of the host country.

This study offers insight into the way in which Chinese and Indian students accomplish their primary goal (academic progression) from a social network perspective. Effectiveness or the enabling effects of the network to facilitate academic progression was high for all. This suggests that despite challenges and differences, students are successfully making their social networks work to achieve their academic goals. Note, however, that an examination of the cultural implications was not a part of this study. The effects of culture, are however, likely at play in these results.

Chinese females have built effective networks. They appeared to have purposefully (and instrumentally) selected network members whose English language ability was better than their own. More have an acquaintance and a weak link to the first person in their networks, and more members have a university role. The benefits of weaker links in the networks are supported by high effectiveness rating of Chinese females.

Density and homogeneity notwithstanding, Indian students have built efficient networks. With fewer members, Indian student's needs are being met. Students are satisfied and the networks are effective.

Density, homogeneity, and network size are not related to network satisfaction. The lack of statistically significant differences among groups supports this. Further, density, homogeneity, and solidarity of males are similar but the two groups of males do not agree on satisfaction.

Implications of the Study

Implications for Practice

Students were not entirely satisfied with the sizes of their networks as they relate to the support needs identified. Both male and female Chinese students want bigger networks and slightly under half of Indian students wanted larger networks. Cross-cultural programs or other opportunities to foster weak links should be encouraged. Efforts to work with these students to build new, non-homogeneous ties also should be encouraged. This should include social and academic events as well as college, lab, and research activities.

Faculty who work with international students should be aware of the findings of this research. Enabling the student's networks through class projects might serve to increase network satisfaction and academic progression.

The goals of nationality-based and social associations whose purpose is to reinforce a student's culture should be balanced against the insularity these organizations potentially foster. It is possible that continued cultural reinforcement through these social means negatively affect the student's integration into the host community.

English language ability appears to have a significant role in the networks of the Chinese students. Lack of strong English language skills might be causing Chinese students to remain within their homogeneous network. Comfort level with Chinese females to interact with those with stronger language skills is an advantage. Language skills might be easier for females to acquire, enabling the females to build their networks to non-homogeneous others. Opportunities to provide more English language skills to the Chinese males could help counter the effects of a non-homogeneous network.

Implications for Research

Chinese students and Chinese and Indian females are the most interesting in terms of their network behavior: Chinese males and females because their network behaviors are often polar; females because they more readily step out of their homogeneous, dense networks. The tendency of Chinese males to do the opposite and stay within their homogeneous networks negatively affects satisfaction; also, presumably needs remain. Further study to uncover the reasons for these differences is needed.

The networks of Indian females are similar in some ways to the networks of Chinese females. Also, Chinese male and Chinese females networks differ. Studies examining these networks more closely by gender and within country would enhance the value of the current research. Specific questions that this research raises include why are the networks of Chinese males and females different? What is the effect of student's English language ability on network formation? What cultural differences exist between Chinese males and Chinese females and between Indian students that affect network formation?

Another interesting result was that females tended to form similar networks. They tended to have more weaker links than males and as a result tended to have less homogeneity and less density in their networks. Further research is needed to flush out why this is the case. Do females, in general, tend to have networks of weaker links? Also why do Chinese females tend to have university personnel as network members and Indian females not? What are the factors contributing to this behavior? Are effects the results of specific cultures?

Many of these students are associated with their nationality-based campus organization. Do these contribute to the insularity, density, and homogeneity of the networks? How long have

these networks been formed? For example, how long have the student friends been students at the university? Are they all in the same cohort? Are their networks insular unto themselves? What are the effects of differences in length of time network members have been in the network?

Finally, males network behavior is of interest. Males tended to have higher density and homogeneity in their networks. Why is this? And why do they tend to have fewer weaker links?

Network studies are conducted in a number of ways. A best approach would be a blending of survey and interview. The length of this survey and the repetitive nature of the questions for each network member caused some confusion with some students despite the fact that it was designed with the assistance of members of the populations and pre-tested by several more students. Language is an issue. This research would have benefited from interviews with the students which included interpreters. Information gathered from interviews has an opportunity to be much richer.

Finally, cultural behaviors were not a focus of study in this research. Clearly, however, culture is at play in the formation and operation of these students' networks. Both culture related to country of origin and ethnicity as well as culture associated with the student's academic discipline and department influence network formation. Research on the cultural aspects of network formation would be a most interesting study.