# ENGINEERING STUDENT SOCIAL CAPITAL WITHIN AN IN-CLASS PEER TUTORING PROGRAM: SOURCES AND PREFERENCES

By

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

MASTER OF SCIENCE IN CIVIL ENGINEERING

WASHINGTON STATE UNIVERSITY
Department of Civil and Environmental Engineering

MAY 2010

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## ACKNOWLEDGEMENTS

The author wishes to acknowledge the financial support of the National Science Foundation under grant EEC0836013 which provided the funding for this project. Also the author wishes to acknowledge the support provided by the Department of Civil and Environmental Engineering at Washington State University and the Department of Civil and Construction Engineering at Oregon State University.

There are a number of people who have contributed to the research process who must be courteously acknowledged. Of particular note are Dr. Shane Brown who provided a source of guidance to the author throughout the project; Dr. Larry Flick and Katie Gillespie at OSU who assisted in the interview process; Laura Girardeau who transcribed most of the interviews; and Mrs. Renee Peterson, Dr. Cara Poor, and Dr. Niki Schulz, who incorporated ICPT in their classes and graciously allowed the author to interview their students.

In addition, the author is the grateful recipient of the constant love and encouragement provided by his parents William and Margaret Street and his two sisters Melissa and Christina which sustained him throughout the project. He also wishes to acknowledge the support and encouragement provided by his friends Kristina Hammer, Carrie Schramm, Katherine Swanson, and Inès de Sainte Marie during the course of the research process and the writing of this paper as well as the companionship of his other friends and colleagues. Without the help and support of these people, this work would have been much more difficult to complete.

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Abstract

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May 2010

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Social capital is defined as resources that exist within social networks and are accessed via interactions among network members. Given the difficult nature of the engineering curriculum at most institutions, resources, including those provided by social capital, are important for students. The motivation for this study was to investigate the role of social capital for sophomore engineering students and to explore the various factors affecting its presence.

The central purpose of this study was to determine student perceptions of social capital and the factors which affect student access to it in the context of an in-class peer tutoring program. This was accomplished by collecting information about the resources accessed by students and the role that these resources play in students' academic lives. Student interviews provided the principal means of data collection and focused on student resources and why students choose to access those resources. The role of an in-class peer tutoring program in resource sharing among students was also investigated.

The findings of this study indicate that the sources of information included teachers, classmates and in-class peer tutors. Social capital proved to be an important asset to most students interviewed. Course difficulty, instructor approachability, and classroom atmosphere

were all identified as factors which can have a significant effect on student access to social capital within the sophomore level engineering classroom setting.

Social capital has high potential value for sophomore engineering students and is affected by factors which can indicate its accessibility and value for students. In addition, the results from this study can serve as a basis for the development of a model for social capital in engineering education.

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## DEDICATION

This work is lovingly dedicated to my grandparents, Vito and Maria Borrelli, who have always encouraged me and who taught me to value what is most important in life by the example of their own.

And to Bill and Margaret Street who have loved and supported me through all life's endeavors and who instilled in me the values of hard work, patience, and perseverance.

## INTRODUCTION

The engineering disciplines are known to be a difficult area of study and many people leave this field in favor of others which are seen as less academically demanding (Seymour & Hewitt, 1997). For those who choose to stay, there is an abundance of resources available to help them achieve their degrees, including teachers, classmates, textbooks, and even the internet. It is likely that such resources play an important role in the achievement of academic success for students (Murnane, 1975; Rivkin, Hanushek, & Kain, 2005).

A significant body of research has investigated relations between social resources and both retention and academic achievement. Carbonaro found that social support and connectedness was positively related to student retention and mathematics achievement test scores (Carbonaro, 1998). In another study of university undergraduate students, Etcheverry, Clifton, and Roberts found that perceptions of support from other students related positively to student self confidence and grade point average (Etcheverry, Clifton, & Roberts, 2001). Social support has been shown to be a key factor in student success both for children (Wentzel, 1991) and for those in college (Astin, 1993; Pascarella & Terenzini, 1991).

Social support is often manifested as human resources, which are defined by individuals who serve as sources of information because of their personal knowledge or skills, which has been shown to be an important resource in both business and education contexts (Lin, Cook, & Burt, 2001). Social capital provides one way of understanding access to human resources. Social capital is defined as resources which are embedded in social networks that are purposefully mobilized by members of the network. With this framework, it becomes easier to understand the value which students place on social resources, and the reasons why they access these resources.

The focus of this project is on the factors which can influence the development of social capital among sophomore engineering students within the context of an in-class peer tutoring program. In-class peer tutoring is a program which facilitates instructional interaction between undergraduate students at different academic levels in which more advanced students help less experienced peers with in-class active learning exercises and homework assignments. Resources which comprise social capital are investigated as well as factors which consider classroom, instructor, and curricular characteristics that serve to motivate students to access different manifestations of social capital available to them. Because social capital exists within the context of social networks, it is important to understand these networks in order to better understand how social capital is viewed by students.

## LITERATURE REVIEW

### *DIFFICULTIES OF ENGINEERING*

Engineering programs, as well as the other Science, Technology, Engineering, and Mathematics (S.T.E.M.) disciplines, are notorious for their high level of difficulty and intensity (Seymour & Hewitt, 1997). Engineering students indicate prominent reasons for why engineering can be a difficult major: the overwhelming volume of material, the fast pace of the courses, and the conceptual difficulties encountered (Astin, 1993; Seymour & Hewitt, 1997). Typical student reactions to the engineering curriculum are, "I was just astounded at the quantity of work – overwhelmed would be a good word for it. I was just stunned" (Seymour & Hewitt, 1997), indicating the difficulty and large volume of work required.

Specific examples of student difficulties include the sequential nature of understanding mathematical principles and failure to visualize conceptual progress (Seymour & Hewitt, 1997). Such difficulties are often exacerbated by a lack of resources. Seymour and Hewitt found that inadequate help with academic problems and a lack of peer group support along with inaccessible or unapproachable faculty were some reasons why students decided to leave S.T.E.M. disciplines. Another study also cited similar reasons why students became dissatisfied with the sciences naming poor departmental support and the absence of community as specific problems (Tobias, 1990).

Poor teaching has also been cited as a cause of student difficulties. Poor teaching is characterized by a sense of aloofness and elitism among faculty (Seymour & Hewitt, 1997). One study found that 66% of teachers employed didactic lectures exclusively, and that 59% of teachers rarely or never implemented brief in-class learning activities (Felder et al., 1998). High

levels of attrition have been attributed to poor teaching (Seymour & Hewitt, 1997). This may be due to the incompatibility of the active and inductive learning styles of students with the deductive and passive teaching styles often used by professors (Felder & Silverman, 1988).

Because of the high level of difficulty of the curriculum, students often rely on the resources available to them for assistance. This helps facilitate learning and information sharing among students which can assist them through these difficult courses. A delicate balance between challenges and support is required for student success (Felder & Brent, 2004). This support often includes text books, class notes and online resources. Resources such as teachers, T.A.s and fellow classmates provide help to many engineering and science students (Seymour & Hewitt, 1997).

Astin also noted the high level of difficulty in many engineering programs during an extensive study in which he attempted to investigate influential factors on college student development (Astin, 1993). He found that for all undergraduate students, peer groups and faculty environments are the two most influential factors for achieving favorable educational results. Of these two, the peer group was determined to exercise the most influence on student growth and development during the undergraduate years. Astin, however, focuses only on the peer group's influence on student development through the concepts of acceptance and approval. He does not illustrate how the peer group can serve as an academic resource for engineering students, or how engineering students overcome specific difficulties (Astin, 1993).

The peer group mentioned by Astin is only one piece of a large reserve of potential resources available to engineering students. These resources exist in a variety of forms including, text books, lecture notes, and the internet which all contain information and are available and

accessible to students. Resources are also embedded in human sources, such as teachers, classmates, and tutors which, like non-human sources, contain useful information. Though sparsely investigated in the educational setting, human sources are heavily relied on in the business setting where coworkers prefer human sources of information over non-human sources (Allen, 1977). It is likely that the same may be true for engineering students given the high level of difficulty in most programs. Unlike non-human sources however, resources embedded in other people must be accessed, or mobilized through social interactions among individuals who are members of the same social network. Some examples of network members include coworkers and classmates (Lin, Cook, & Burt, 2001).

### *What is Social Capital?*

In engineering disciplines characterized by high levels of difficulty, resources are especially important and often not available for students. Human resources are one type of resource that is important, and the framework of social capital provides a lens through which to examine this resource in various settings. Social capital has been defined as "resources embedded in social structure which are accessed and/or mobilized in purposive actions" (Lin, Cook, & Burt, 2001). Etcheverry, Clifton & Roberts defined social capital similarly as exchanges of information through social relations within social structures (Etcheverry, Clifton, & Roberts, 2001). Others have expanded that definition to include social networks themselves and the social norms related to the networks (Halpern, 2005).

This project addresses all components of social capital, resources, networks, and norms. In this study, social networks are composed of the social connections which exist between individuals in an engineering higher education setting and can include faculty, peers, and others.

Norms are informal social rules that can govern behaviors and interactions within a social context. For example, what information students access (resources), where students go to get it (networks), and why do students go there (norms) are explored.

### *Social Capital in Higher Education*

It is because of social interactions that social capital is easily applicable to higher education settings where students form relationships with various individuals including professors, teaching assistants, and other students (Etcheverry, Clifton, & Roberts, 2001). When studied in higher education, social capital can also have implications across a range of common issues for students including time management, social issues, poor teaching, and personal values and beliefs (Astin, 1993; Pascarella & Terenzini, 1991; Carbonaro, 1998). The current study however, only focuses on the resources themselves which are embedded in social networks and the factors influencing their use by students.

This focus however, is somewhat divergent from the construct of social capital as applied elsewhere. The construct of social capital in other studies mainly focused on social norms and the density of the social networks among individuals. Related concepts such as sense of support or social norms, as utilized in previous research, may indicate the availability and mobilization of resources, but do not discuss the types of resources available nor the reasons why students access certain resources over others. Likewise, an understanding of the density of social networks can help to create a numerical description of social connections but fails to provide a rich and detailed account of resource mobilization.

Though it may seem obvious that social capital is important for students, little research has been undertaken to investigate student access to information. Astin's study indicated that

peer interaction yields positive benefits for students and that communication among students has the potential to influence student growth and success. However he did not explore how resources, such as the peer group, served as academic aids leading to success (Astin, 1993).

Despite the lack of research on social capital and education, much has been done to illustrate the benefits of social capital in other fields. Studies have demonstrated that employees are much more likely to use other people than non-human sources to access information (Allen, 1977), and social capital has been found to be a factor in the economic prosperity of Silicon Valley (Saxenian, 1994). Social capital has also been shown to increase productivity because the mobilization of individuals creates a collective knowledge base that is larger than that of an individual and such cooperation is often required to accomplish complex tasks (Greve, Benassi, & Sti, 2006). It is apparent from these investigations that social capital is an effective way to examine the relevance of information sharing among members of social networks.

One study that did explore social capital and confirms the particular need for using other students in a challenging academic environment took place in an engineering laboratory and found that information sharing among students is inspired by a need for information that is not available apart from other students (Brown, Flick, & Fiez, 2009). The study concluded that such conditions will encourage student interactions intended to mobilize the resources available in their peers. While this study established some conditions which lead to information sharing among students in a laboratory setting, it does not comprehensively treat the resources and factors which characterize student interactions within a more traditional lecture environment. Using the exploratory methods of qualitative analysis, the current study built on these prior investigations to gain a deeper understanding of social capital among engineering students within the context of an in-class peer tutoring program.

*TUTORING*

Tutoring is one social resource that is available in various forms at many universities and its benefits have been investigated extensively. Tutoring is commonly defined by one-on-one interactions in which knowledge is transferred from one party to another. Some have indicated that engineering curricula are likely to engage students in group activities such as tutoring (Astin, 1993). Learning gains have been identified for both tutors (Roscoe & Chi, 2007), and tutees (Cohen & Kulik, 1982; Cohen, 1986). In one meta-analysis study, three general outcomes of tutoring were identified: improved academic progress, more positive attitude toward subject matter, and improved self-concept (Cohen & Kulik, 1982). Another study found that 87% of tutored students showed higher levels of academic performance than control students (Robinson, Schofield, & Steers-Wentzell, 2005). In higher education specifically, peer tutoring has been shown to be as effective as tutoring by faculty and to have a positive influence on examination performance (Topping, 1996).

Such benefits are offered by many implementations of tutoring, but the one of interest in this study is peer tutoring. Peer tutoring is defined by Cohen as tutoring in which the tutor and the tutee are of similar academic standing (Cohen, 1986). The classes studied in this project incorporated an in-class peer tutoring (ICPT) program which consisted of peer tutors assisting students during in-class active learning assignments once a week, with the same tutors holding office hours outside of class. One reason that peer tutoring can be such an effective teaching mechanism is that peers are often more familiar with students' cognitive framework than professors, and can thus communicate differently, and sometimes more effectively, with students. This communication of knowledge is also enhanced by the low power differential between peer tutors and students, creating a less threatening environment (Cohen, 1986). The

interactions with peer tutors can also serve as a social experience which can help students learn how to interact with peers at a professional level (Cohen, 1986). This positive influence on communication skills has the potential to facilitate students' access to human sources of information which can result in social capital development among students.

What could not be found in the tutoring literature was a detailed description of reasons that students access tutors for help. The research done in the business field, which illustrates that human resources are preferable to other sources of information, can help form ideas about why social capital may be important for engineering students. Both employees and engineering students are required to complete challenging tasks which often require information from various sources, especially other people. However, little is known about the resources preferred by students and how and why those resources are accessed.

## PURPOSE OF THE STUDY

The purpose of this study is to use the framework of social capital to investigate the human resources and the various factors influencing student mobilization of these resources among sophomore level engineering students in three ICPT courses. These students were enrolled in classes which incorporated peer-tutoring at two universities located in the northwestern United States, Washington State University and Oregon State University. The current study seeks to better understand the factors which may facilitate student access to social capital.

### *RESEARCH QUESTIONS*

These goals were addressed with the following research question and sub-questions:

What are sophomore engineering students' perceptions of social capital relative to learning engineering mechanics?

a. What resources do students report as important to their academic success?
b. What factors influence student access to resources pertinent to their academic achievement?
c. What contextual factors lead students to prefer to access some resources and not others?

## RESEARCH SETTING

This research project is part of a larger investigation on an in-class peer tutoring (ICPT) program that has been in place at Washington State University since the fall term of 2007. The focus of the current study is social capital within the context of the ICPT program during the Spring 2009 term of statics and mechanics of materials (MoM) at Washington State University (WSU) and statics at Oregon State University (OSU).

### *CLASSES STUDIED*

Both WSU and OSU are public land grant universities in rural settings with between twenty and twenty-five thousand students. Each has a strong engineering college with six departments at OSU and eight departments at WSU. The classes studied had approximately sixty students at WSU and one hundred twenty students at OSU. At OSU, statics classes also included a weekly recitation run by the teaching assistant with approximately 25 students. This recitation was independent of ICPT, which took place in addition to the established recitation sessions. At both institutions, statics is a sophomore level engineering class offered by the department of civil engineering. Mechanics of materials is another sophomore level class taken the term following statics and is also offered by the department of civil engineering. The sections of these classes investigated here include every section which incorporated in-class peer tutoring. This includes one statics class at OSU and WSU and one mechanics of materials class at WSU. The students taking these classes are primarily from the civil and mechanical engineering disciplines, with a few from other fields of engineering.

The instructors for all these classes were faculty who focus primarily on teaching undergraduate courses within their department with less time spent on research. They are generally seen as effective instructors, and are well liked by their students and fellow faculty. These instructors are often noted by students to be concerned about their students and their students' learning. Students often indicate a preference for these teachers over others because of the clarity of their teaching styles, organization, and realistic expectations of their students.

### *What is In-Class Peer Tutoring?*

All the teachers of the classes studied in this project incorporated in-class peer tutoring (ICPT) in their classes and it is important to identify exactly how peer tutoring is defined in these classes. Other projects have evaluated a variety of peer tutoring programs that have been employed at all levels of education, from kindergarten to higher education. For the current study, peer tutors are students who volunteer for the position after completing the course during a previous term and are selected by their teachers based on academic achievement, personal interest, and attitudes towards teaching. These peer tutors are intended to facilitate student interactions and understanding of course concepts.

For the current project, peer tutoring consists of two components. The first component of the ICPT program takes place during designated class meeting time. At both universities, peer tutors attend the class during the scheduled lecture period approximately one day each week, and assist students as they work through in-class active learning exercises, which reflect current course concepts. This activity lasts approximately 15-25 minutes and the teacher, as well as the peer tutors, are present during this time to help students with the activity. Several days prior to each class designated for these activities, peer tutors are given the exercise so that they can work

through it on their own and gain a solid understanding of the problem and applicable concepts. Peer tutors also meet with the course instructor to discuss the exercise prior to the class, which ensures peer tutors understand the concepts required to complete the in-class activity. During the activities, students can ask the peer tutors for assistance or the peer tutors can initiate contact with students as they circulate around the classroom.

The second component of the ICPT program takes place outside of the scheduled class time. Each of the peer tutors holds office hours at some point during the week where they are available for students to ask for help with homework, studying, or class projects. Unlike the in-class portion, there is little structure during this time, and the course instructor is not present. This is an informal time for students to complete class work with the help of the peer tutors and other classmates.

## METHODOLOGY

### *RESEARCH PERSPECTIVES*

Qualitative research methods were used because they provide a "source of well-grounded, rich descriptions and explanations of processes in identifiable local contexts" (Miles & Huberman, 1994). Because this project was interested in individual perceptions of social interactions and the factors which influence them, an interpretive approach was adopted for exploring the research questions. As explained by Patton, the central assumption of the interpretive perspective is that individuals view the same social setting and experiences in different ways (Patton, 2002). This perspective permits a detailed examination of complex social settings and results in a holistic understanding of those settings and the factors which influence them based on the interpretations of the researcher.

Prior experiences of the principal researcher in each of the classes studied played an influential role in the development of the data collection instruments. His experience with the subject matter and the concerns and challenges faced by students, facilitated interactions with students and provided a better understanding of the context of student experiences and observations. As a student, the author never had peer tutors, but volunteered as one on numerous occasions. This insight provided the researcher with a preliminary understanding of the potential benefits that ICPT can offer students, and gave the researcher a unique perspective with which to view student responses during data collection and analysis. The interviewer at OSU lacked experience in engineering classes, but had extensive knowledge of education and human learning behavior, which also helped in the process of interviewing students.

*SUBJECT SELECTION*

At each institution, 10-13 students were selected for in-depth interviews near the end of the term. Subjects were purposefully selected based on responses to a survey administered during the middle of the term to statics students at OSU and statics and mechanics of materials students at WSU. The purpose of the survey was only for sample selection. Two criteria were chosen to ensure that all students in the class were represented: student views on the helpfulness of tutors, and academic achievement evaluated using GPA. The Likert scale questions of the mid-term survey are part of an ongoing assessment of the ICPT program and are discussed elsewhere. This anonymous survey included eight statements in which students were asked to state their level of agreement based on a Likert scale ranging from completely agree to completely disagree. The internal consistency reliability was 0.8 as measured by cronbach alpha. A complete copy of this survey may be found in Appendix B.

A representative question from that scale is student level of agreement with the statement, "the peer tutors have been helpful to me in this course." Based on responses to this question, students were ranked and then subjects selected across responses to achieve an even distribution of responses among subjects. Ideally five would have been chosen in the following categories: completely agree, neither, and disagree. However very few students answered disagree or somewhat disagree. Groupings of students for selection was then modified to completely agree, somewhat agree, and a third group of responses neither, somewhat disagree, and disagree, with approximately five students selected from each group. Professors then provided a list of student ID numbers ranked in order of GPA and subjects selected based on survey responses were identified on the list so that some members of each group were high, medium, and low achievers as compared to their fellow students.

*DATA COLLECTION*

The data collection tools employed by this study included semi-structured interviews with selected students and an end-of-term student survey administered to the entire class. Interviews provided an effective means to characterize and synthesize exactly how students view access to resources. Since many students may not be familiar with the concept of social capital or its associated vocabulary, questions encouraged students to discuss their own thoughts and experiences as related to social networks and interactions within the context of the academic setting, and avoided the use of confusing terminology surrounding social capital.

The interview protocol was organized into three categories, each containing several important questions that were presented to each student interviewed. These principal questions are presented in their respective categories in Table 2 below. Additionally, each of these questions was accompanied by a series of supplementary prompts which were intended to stimulate conversation and clarify ideas related to the principal question. The first category dealt with students' experiences of social capital in the engineering curriculum in general, for example students were asked about problems they encountered in their various engineering classes. Some supplemental prompts included what barriers students encountered and if they had experienced anything which impeded their learning, and what resources were helpful to their learning. The second category questioned students about experiences in the class in which ICPT had been implemented (statics or mechanics of materials), without specific mention of ICPT. This helped to identify factors related to social resources available to these students. The third category dealt specifically with the in-class peer tutors and how students do or do not view them as resources. Some students independently introduced ICPT, but others only discussed their feelings and experiences regarding peer tutors when directly questioned by the interviewer. Many students

were quite comfortable in the interview sessions and freely discussed details without much probing; however, some of the more timid students needed more encouragement, which is why the supplementary prompts were included in the protocol. A complete copy of the interview protocol used is provided in Appendix A.

| General Engineering | This Particular Class | ICPT |
|---|---|---|
| Do you ever experience any academic problems in your classes? | Is there a supportive environment in the class? | Describe the peer tutoring program in this class as if you were explaining it to a friend in another section. |
| In what way is your department supportive of your learning? | What is the instructor for this course like? | Could you talk about an experience you had with the peer tutors? |
| Assuming a professor is a resource, are there other resources that are available to you? | | Do you think peer tutors are a valuable resource with respect to learning? |
| | | Would peer tutors be good in some of your other classes? |

**Table 1. Interview Protocol**
This table gives a brief outline of the principal talking points from the interview protocol. Each of these served as a basic topic which was qualified by a series of supplemental questions and prompts. Each of the listed questions was asked during each interview, however only some prompts were used at the discretion of the interviewer.

Two graduate assistants, one at WSU and the other at OSU, conducted the student interviews. At the outset of the project, a planning meeting was held with all parties involved to achieve mutual understanding among individuals. Once the interview protocol had been validated with pilot interviews, a meeting was held between interviewers to discuss the protocol. At this time, three interviews were conducted with both interviewers present. Phone interviews and e-mail communications were regularly employed throughout this process to ensure

continuity. At the conclusion of the interviews, another meeting was held to discuss common themes and trends that emerged while talking with students.

During the interviews, building a personal rapport was encouraged by creating a friendly, conversational environment which was designed to help the subject feel comfortable and relaxed about expressing personal experiences and thoughts. Subjects were also encouraged to frame their comments in their own individual terms. It was presumed that since the information pertinent to this study is social in nature, such an environment was more effective for the exploration of this type of data. Interviews took place during the next to last week of the term at both institutions. As ICPT may have been a new concept for many students prior to the start of the term, this timing allowed students to have sufficient exposure to ICPT before evaluating its potential effectiveness as a resource.

Finally, an open-ended survey was developed and administered to the entire class to confirm the emergent themes from the interview results with a broader, more general audience. The employment of interviews and surveys provides cross-data validity checks (Patton, 2002). Care was taken to include questions which required thoughtful, well-written answers, encouraging students to provide meaningful feedback. One question asked about the strategies students used to conquer challenges. Other questions asked about student opinions related to the classroom atmosphere and structure and also their likes and/or dislikes of peer tutors. This survey was distributed to all students in the statics and mechanics of materials classes which incorporated ICPT at the conclusion of the term. A complete copy of this survey may be found in Appendix C.

## DATA ANALYSIS

The interpretive perspective employed here denies the idea that there is a universal reality, and focuses on the interpretation of the data as presented by the individual in his own terms (Patton, 2002). Thus, it is the task of the researcher to analyze this data and determine trends which can be observed across a range of individual statements. For this project, coded data consisted primarily of interview transcripts which were analyzed using the constant comparison method. This method involves comparing new pieces of data with existing data trends (Maykut & Morehouse, 1994). If a piece of data does not fit the existing trends, a new trend is assigned and all existing data is reviewed to identify other occurrences of this trend (Miles & Huberman, 1994). The smallest unit of data for this study is a student statement which consists of words or phrases intended to convey an idea of a participant. Because this study seeks to describe and analyze the effects of social interactions and the resources that result from those interactions, the trends developed focus on personal experiences. Such experiences include social contact between the subject and various individuals including professors, tutors, or peers. Also included are behaviors and opinions which help classify the types of interactions by which students can access resources.

The process of creating codes to capture these experiences and behaviors is a process frequently utilized for reviewing qualitative data, especially interview transcriptions. The process aims at dissecting meanings and themes while maintaining links between the various statements (Miles & Huberman, 1994). The process involves assigning various labels or ‘codes’ to words or sections of text which convey a particular meaning so that data can be organized for analysis (Creswell, 1998). Coding for this project was done in two phases with the assistance of ATLAS.ti, a qualitative data analysis software program (© 1991-2006, ATLAS.ti Scientific

Software Development GmbH). The first phase consisted of relatively unstructured categorization of data to identify common statements made by students. The first phase of indexing was not intended to achieve the goals of this study, but instead to help the researcher become familiar with the data and its most general patterns.

The second phase of indexing was more analytical and has been referred to in other studies as “pattern coding” (Miles & Huberman, 1994). It was the intent of this phase to identify trends within the general patterns established during the first phase of analysis and verify those trends. The intent of this phase was to identify the resources which comprise student social capital, and also to investigate how social capital is developed among students. For example, some trends included resources accessed, social norms, interactions with tutors, peers and faculty, and departmental involvement.

While the process of creating these codes facilitates the analysis, it does not complete it. Themes were layered and interrelated in order to help draw conclusions about social capital and its implications. In addition to verbalized individual experiences regarding ICPT and other academic social interactions, personal reflections and supplemental findings from end-of-term surveys also helped to provide a more complete picture of social capital and the various factors which influence its use among sophomore engineering students.

The type of qualitative data analysis undertaken here may seem subjective, but the employment of validation methods can provide credibility by strengthening confidence in findings (Patton, 2002). It is important to note that while qualitative researchers use different methods to describe quality of research, the two primary aspects of measurement are credibility and dependability (Leydens, Moskal, & Pavelich, 2004). Credibility addresses the strength of the

methods, and the ability of the researcher, while dependability refers to how analogous results would be in a similar study undertaken by different people (Patton, 2002).

One way to strengthen confidence in a study is done by combining methods. This is often called triangulation because in surveying, three points are needed to determine a location (Patton, 2002). There are several forms of triangulation that can be employed in a study. In the current study, methodological triangulation was achieved with the integration of interview and survey results to study a single issue (Patton, 2002).

Investigator triangulation was also implemented in this study through a process of check-coding. In this process, several researchers independently code the same data set and discuss differences, ensuring a consensus of which blocks of data best fit each code (Miles & Huberman, 1994). In the current project, after several iterations, an intercoder reliability of 84% was achieved, indicating consistency of data interpretation. These forms of validation serve to fortify trends in the data and lend credence to the findings of this study.

## RESULTS AND FINDINGS

Student responses provide a more detailed understanding of social capital and the factors which influence its presence among sophomore engineering students. Results indicate that there is an abundance of resources available to students enrolled in the engineering curriculum and that preferences for accessing these resources are dependent on classroom and individual factors. This section of the report will discuss student responses and the way these responses indicate how some of those resources constitute social capital as described earlier.

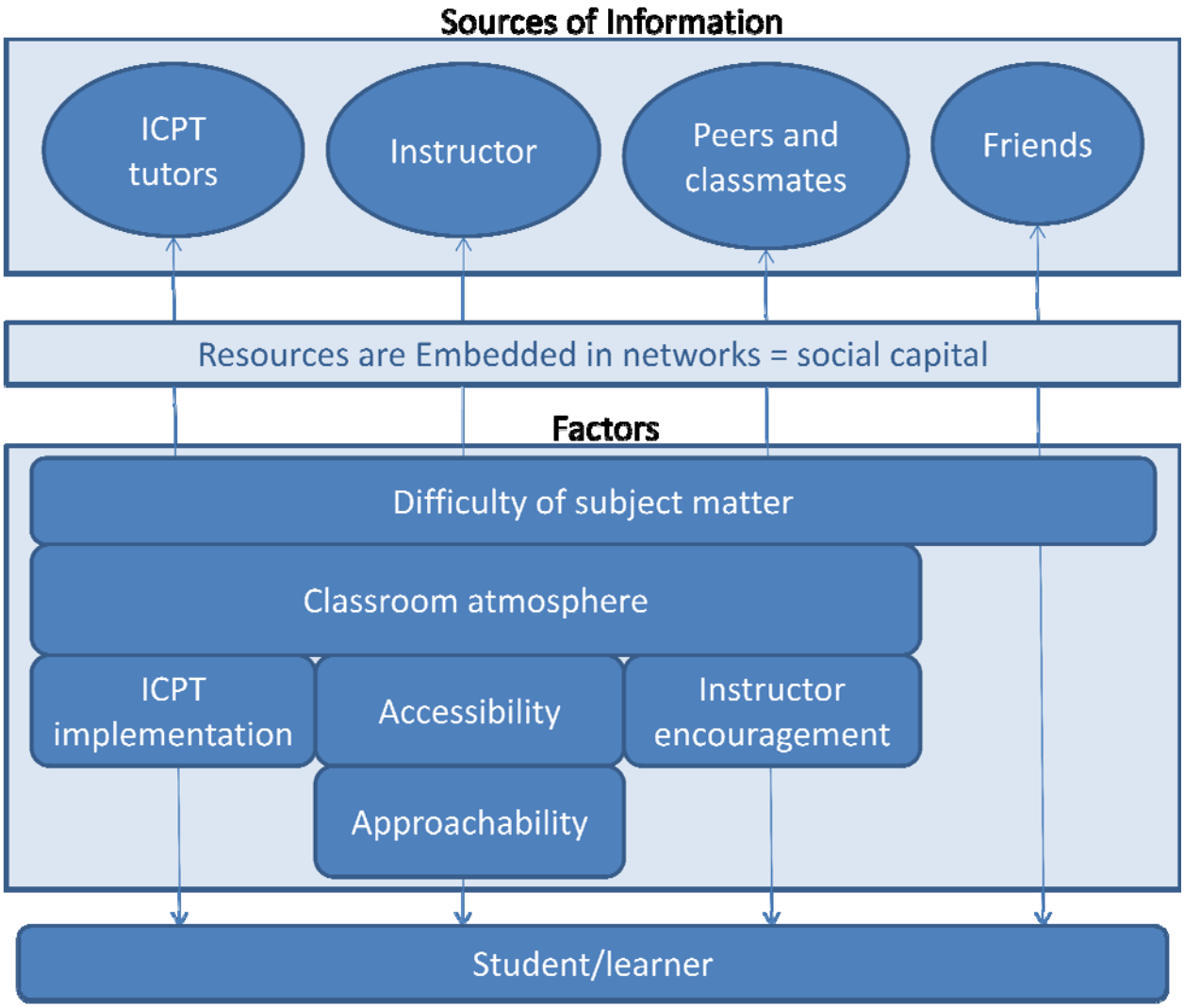
### *RESOURCES*

There is a large variety of resources available to students including human resources. Many of the resources mentioned by students are available within the context of a social network and are accessed via personal interactions, for example social exchanges between teachers and students. Based on interview responses, many of the resources most commonly accessed via personal interactions are human resources. These include tutors, classmates, and teachers.

Figure 1 illustrates the most common sources of information mentioned by students interviewed which are associated with social capital. These are listed in the first box at the top of the figure and include ICPT, instructors, classmates, and friends. These resources are discussed in detail below, are all accessed by students through personal interactions (represented by vertical arrows), and comprise social capital. Several factors were found to influence student mobilization of these resources and are presented in the central box of Figure 1. Among these is the difficulty of the subject matter, affecting student access to all the social sources of information. Another influential factor included classroom atmosphere, which affected student interactions with both ICPT tutors and teachers. Resources available via peer tutors were also

affected by faculty design of the particular course and the incorporation of ICPT in the classroom. Accessibility and approachability were two factors found to impact student access to resources via social interactions with instructors. The resources available in peers and friends were affected by the difficulty of subject matter and to some extent by teacher encouragement that students utilize these resources. The implications of each of these factors for student access to resources will be discussed in the following section.

**Figure 1. A picture of Social Capital**
This figure illustrates social resources available to statics and mechanics of materials students. Arrows illustrate the transfer of information from its embedded location within a social network, to students which is social capital. Factors which influence this information transfer from the resource to the student are also illustrated.




Among the social resources illustrated in Figure 1, instructors were mentioned with the most frequency by both statics and mechanics of materials students at both institutions. Generally, instructors have substantial and regular contact with students and are traditionally the principal source of assistance to students. One student expressed his preference for the instructor, "I often talk to the teacher first because she's teaching the class…not only to get help, but she

knows you're trying. That's important because she's more apt to spend more time with me, the more time I spend trying to figure it out and asking for help" (WSU statics student).

Recognizing this important role, almost all instructors hold office hours and are willing to help students learn the material. One student summarized his appreciation for the statics instructor's attitude, "she really knows what she's talking about...and she has a really good attitude. I don't feel like she's being strictly professional. She makes the class fun and it makes it easy to pay attention" (WSU statics student). Another statics student from a different class expressed similar sentiments about his teachers' approachability, "our civil engineering teachers always have their doors open, always really wanting you to come in and talk to them and if there's any problems or anything that needs to be brought, you know, to kind of the forefront or any issues, they're right there, and it does feel like it's supportive" (OSU statics student).

Statics students were not the only ones who reported their instructors as valuable resources. Mechanics of materials students also indicated that they thought instructors were an important source of information for understanding problems. One student expressed how his instructor helped him when he encountered difficulties, "for homework, I guess it was at the beginning of Mechanics, I would go see Sue [the teacher]. When we first learned it, I was confused about the 3D stuff. I couldn't visualize it, but she helped me" (WSU MoM student). These students, and many others, indicated that instructors were among their primary resources for subject related assistance in both statics and mechanics of materials.

Another resource mentioned by students was the in-class peer tutors. Students indicated that in-class peer tutors were an important resource because they provided an extra person to which students could direct their questions during the in-class sessions. One student reported

how the presence of the peer tutors provided an additional resource which was not available in other classes, “I might just be sitting there not knowing [what to do], and then a lot of times what will happen in other classes is we’ll do an in-class problem but I don’t know how to do it, so I don’t get it … but in statics what’s nice is [peer tutors] can help me figure it out” (OSU statics student). Serving as social resources, the peer tutors provided an additional means through which students can access information which may not exist in other classes. One example of this is that many students indicated that they wished other classes would implement peer tutors, “[In calculus] there’s so much material to cover, and it’s hard to remember it all. I think peer tutors would be able to help you keep it straight. Whenever you’re doing your homework problems, they tell you this is what you need to know and this is how you approach the problem” (WSU statics student). Comments like this indicate that students see the peer tutors as a valuable resource that could prove beneficial to their academic endeavors.

In addition to teachers and peer tutors, a third resource mentioned by most students was their peers and classmates. Comments indicated that many students relied heavily on other students for help with homework and studying. Because this resource is accessed through social interactions, it also constitutes social capital for students. One student expressed how he used his friends and classmates as an academic resource, “I formed a study group with some people in [mechanics of materials]. Because I have an hour break before that class. We sit in the lounge and talk it over, go over homework and stuff. Those guys I’ve become friends with” (WSU MoM student). Another student also indicated why he thought interactions with his classmates could serve as a resource, “I’ll ask other people in my class for help. Me and two other people in Statics, we study together every day, every time before an exam. We spend a whole evening

studying for the exam together. That helps a lot because if one of us has a question, one of the others pretty much is able to help out" (WSU statics student).

Students also mentioned peers or friends from outside the class as a source of academic information. These were often students who had previously taken the course and could offer advice and help on homework. This resource is embedded in the social network of the various students and is accessed through existing personal relationships. Comments indicated that students relied on these additional resources for help with homework or other concerns, "I have some friends that I know, not from the class but, they help me out with it, who took it last term, so…if I got any questions I can ask them" (WSU statics student). Though friends outside of class were not mentioned by a majority of students, they still constitute a social resource which was mobilized by some students during the course of their studies.

Survey results from the end-of-term survey support interview findings that classmates and friends constituted an important part of their social network which provided resources to help solve problems. Approximately three quarters of the students surveyed responded that they used either classmates or friends from outside of class as one of their primary resources when asked about what strategies they used to conquer academic challenges.

Results from the survey also substantiated the finding that students relied heavily on the instructor as a resource. When asked about what aspects of this class they wished could be implemented in other classes, most students indicated that they wished their other instructors possessed similar teaching style and personality characteristics which they found useful in their instructors of statics or mechanics of materials. Survey results also confirmed the relatively low use of peer tutors among statics students. Students who responded indicated that they often did

not feel the need to use the peer tutors in statics. However, when asked about why tutors were not beneficial, most students who commented indicated that they simply did not feel the need to use them, but they were probably useful for other classmates.

Despite the low use of peer tutors, these students still seemed to recognize the potential benefits that this resource could offer in other classes, indicating that peer tutors were viewed by students as a valuable source of information. When asked about what other classes they thought would benefit from peer tutors, calculus and physics classes were mentioned by more than half of survey respondents. This illustrates that even if peer tutors were not heavily used as a resource by all students in this study, students did see the potential source of information that peer tutors could provide in a different context.

### *Factors Affecting Social Capital*

It is critical to examine the factors which guide students' utilization of these resources if student mobilization of the various social resources discussed above is to be better understood. These influential factors can provide insight to student social capital because they indicate student preferences regarding the access of various resources. The primary way these factors supply this understanding is by illustrating aspects of the social networks that facilitate the social interactions through which resources are transferred. The current study identified several factors which affect the various resources identified in different ways. The factors were introduced in Figure 1 and include the difficulty of subject matter, faculty implementation of ICPT, classroom atmosphere, instructor encouragement of students, and the accessibility and approachability of instructors.

*Difficulty of subject matter*

One factor which influenced student access to all four resources identified, was the difficulty of the subject matter. The investigation of resource mobilization in two different classes, statics and mechanics of materials, allowed the researcher to investigate how the difficulty level of the class can affect social capital. In the statics class, a more introductory level engineering class, students commonly indicated that they were able to accomplish required tasks without accessing resources such as their peers, friends, or in-class peer tutors. Students reported that they felt they could succeed without much assistance due to the low difficulty level of the class, "it's funny you asked about peer tutoring, because statics is my easiest class. So I haven't used the [in-class peer] tutors much. I guess the rest of my classes are fairly hard in comparison" (WSU statics student). Another student also expressed how the low level of difficulty caused him not to utilize the peer tutors, "in statics, I think, I like the concept and I know a couple of the peer tutors, and I would feel totally comfortable going and asking them. But it's just that for statics, I don't find the material that difficult, so I haven't really needed to utilize them" (WSU statics student).

Even if resources like in-class peer tutors were not frequently used, students did appreciate the potential value they offered. Many students who did not use the tutors still seemed to appreciate the idea of having tutors available. One student expressed how highly resources were valued, "I think any extra help can always help in engineering. We all need help in engineering, no matter which [field of] engineering we're in. It's the hardest major to choose. So you can always use more" (WSU statics student). This exemplifies the attitude of "the more the better," which was expressed by several students during interviews, even when they reported

little resource use themselves. Students recognized the difficulty involved in engineering and the benefit that having tutors can bring to such a difficult curriculum.

Unlike for statics, in mechanics of materials the higher level of course difficulty seemed to motivate students to make more and better use of their resources and in particular the in-class peer tutors. Mechanics of materials students were not hesitant to use in-class peer tutors for help when needed, and their comments indicated that they viewed the in-class peer tutors as individuals who could work with them to help complete active learning exercises. Mechanics of materials students also seemed to better understand the value of the resources available in the people around them, including both in-class peer tutors and their classmates. One student commented on the importance of working with classmates, "I think [working together] is effective when maybe you're running into difficulties or not quite understanding what to do, you can talk to [your peers]. You know, how they're understanding it and maybe they can help you figure out what you are doing wrong, or you can help them" (WSU MoM student). Because of the higher level of difficulty, students may have been forced to seek assistance from resources which were available, yet largely untapped in statics. This is not entirely unexpected as previous studies have also found that increased course difficulty can increase interactions between students and their professors and peers (Etcheverry, Clifton, & Roberts, 2001).

Student responses to the end-of-term survey also indicated that the level of course difficulty prompted students to desire more resources. When asked which courses they wished had in-class peer tutors and why, many students responded that calculus and physics could use them because they were viewed as "hard classes." It can be inferred then that ICPT was seen as providing an additional helpful resource, and that additional resources are highly sought in

courses with a high difficulty level. Even statics students seemed to express this feeling, saying they wished their other, harder classes incorporated more resources like peer tutors.

*Accessibility and Approachability*

Accessibility also played a role in student mobilization of resources, especially for student interactions with instructors. When students discussed the accessibility of instructors, they often did so in comparison to the accessibility of the peer tutors. One student expressed his frustration about the inaccessibility of instructors, "[peer tutors] are not as imposing as teachers are, cuz some teachers, you know, I don't want to bother them. With teachers it's like I have to get to the point and then get out" (WSU Statics student).

Students also expressed the observation that many instructors, including well liked ones, were inaccessible by identifying them as intimidating. One student indicated that the interaction with peer tutors was not as intimidating as with instructors because it did not require as much structure and formality as with professors, "You're not worried about if you're completely lost if you're trying to ask the professor, who's like, you should know this. [Working with a peer tutor, is] kind of like talking to your friends I guess, and doing homework with them" (WSU MoM student). Other students indicated that they used the peer tutors because they found it easier to identify with them than with the instructors, "[peer tutors] are doing the same thing you're doing, just with tougher classes. They're not like, doing it for a job. They're in the same situation you are" (WSU statics student).

These responses, indicating student preferences for various resources, provide a clearer understanding of the place that instructors and peer tutors occupy within the social network of sophomore engineering students. Because instructors are seen as less accessible than other

available resources, students may be more prone to turn to peer tutors or their classmates, which are often seen as more accessible sources of information.

A factor closely associated with accessibility, which also influenced student interactions with their instructors, was the approachability of the instructor. Based on student comments, it seems that when the instructor is more approachable, students prefer to utilize this resource before seeking help elsewhere. Student responses related how highly approachable instructors encourage students to use them as resources, "Every morning before class I go to [the instructor's] office because I have a question about the homework. She's always very welcoming. 'Oh, come on in, let's go over this!'" (WSU statics student). Another student also commented on how the approachability of the instructor can affect student participation and development, "when the professor is more approachable, students are much more willing to participate…but at the same time that she's approachable and is always there to answer questions, she's always encouraging us to kind of think through it on our own" (WSU MoM student). Other students expressed similar statements indicating that they thought the accessibility of the instructor really helped students to relate to the instructor. This served to fortify connections within the social network which allowed students to tap into this resource more easily.

*ICPT Implementation*

In addition to the approachability and accessibility of instructors, another factor which can improve understanding of resource mobilization is the implementation of ICPT by instructors. It was important that instructors communicated the purpose of the peer tutors to their students in order for the students to fully understand the benefits offered by the peer tutors. This

is a form of metacognitive instruction, which has been shown to be beneficial to the learning process (Commission on Behavioral and Social Sciences and Education National Research Council, 2000). Students, who may be unfamiliar with ICPT, traditionally look to their instructor as an important resource, so it is important that the instructor provide credibility to ICPT by introducing it as an additional resource.

Once instructors have validated ICPT as an effective source of information, students are more willing to use peer tutors as a resource. One student related an experience in which the instructor validated the use of peer tutors for him, "[I asked] one of those questions that was way out there… so I got hold of [the instructor] and she was like, 'ask the person right behind you, there's [an in-class peer] tutor right there'" (OSU statics student). In the statics course at WSU, ICPT did not receive as much credence from the instructor, but was treated more as a supplemental, alternative resource. This lack of instructor validation combined with the high accessibility of that particular instructor and the low level of course difficulty, may have contributed to a reported low level of peer tutor use. In the mechanics of materials on the other hand, ICPT was well integrated by the instructor and student comments indicated that peer tutors provided an important resource that was frequently accessed by this group of students.

*Classroom Atmosphere*

Another factor which can play a role in student mobilization of the resources found in their peers, instructors, and peer tutors is the classroom atmosphere. Prior evidence indicates that students prefer a more nurturing and supportive environment (Seymour & Hewitt, 1997; Tobias, 1990). When such an environment exists, students report that they will more likely access resources such as their instructors, in-class peer tutors, or their peers. ICPT can provide one

avenue which reportedly effects classroom atmosphere by encouraging a sense of openness among the members of the social network within the classroom. One student expressed how the presence of the peer tutors was beneficial because it created an improved learning environment, “the [in-class] peer tutors for her class are also available every day. So there’s a very nurturing learning environment which I like” (WSU statics student). Another student, though he did not use the peer tutors as a source of information, did identify the effect of the peer tutors on the classroom atmosphere as positive, “I think [ICPT] is helpful to succeeding in the class, but I haven’t ever really needed to use a tutor, personally. And having [the in-class peer tutors] it seems like it’s a more friendly environment, which is good” (WSU statics student).

The classroom atmosphere, as affected by the inclusion of ICPT, also encourages students to view instructors as a more accessible resource for students because they seem to care more about their students. One student stated that the incorporation of ICPT was beneficial because it showed that the instructor cared about student learning, “[the instructor has] always been very nice whenever I’ve talked to her and everything, and she’s always provided lots of [in-class peer] tutors. I think that’s pretty great” (WSU statics student). ICPT can have a profound influence on students’ perspective of the classroom atmosphere which can affect their access to resources within their network.

In addition to peer tutors and teachers, the classroom atmosphere can also influence student interactions with their classmates and peers. The presence of ICPT helped create an atmosphere in which students collaborated more with their classmates, as well as the in-class peer tutors. One student expressed how the in-class peer tutoring activities encouraged students to work together with the facilitation of the peer tutors, “when we do the in-class problems we work at least with a partner or a couple people together, and then that group will ask the peer

tutors to come over and help us if we need it. Then the class sectioned off into groups. And then the peer tutors just kind of cover each group and rotate around. Just having them there helps if you have a question" (WSU MoM student). The open classroom atmosphere, which can be encouraged by ICPT, serves to improve interactions between members of a social network which increase information sharing among network members.

*Instructor Encouragement*

While student interaction with peers and classmates can be affected by the classroom atmosphere, student access to this resource can also be affected by instructor encouragement. Some students formed groups during the in-class active-learning exercises which often resulted in increased interactions among students outside of class. One student expressed how he often used his classmates as resources outside of the classroom setting, "I formed another study group with some people in mechanics of materials class. We sit in the lounge and talk it over, go over homework and stuff. Those guys I've become friends with" (WSU MoM student). Another student expressed how the instructor encouraged interaction among students by including ICPT, "[ICPT] helped because the peer tutors were there, they were walking around, and it helped break the tension so people were more willing to talk" (WSU MoM student).

When instructors encourage interaction among students with the inclusion ICPT, students seem to better understand that they can and should use their peers and classmates as a resource. This helps shape the classroom atmosphere as well, which can help foster interactions that allow greater student access to resources such as their classmates, instructors, and the peer tutors. Other factors which indicate student preferences about instructors as a source of information were accessibility and approachability. When teachers displayed these characteristics, students were

more likely to use them as sources of information when faced with difficulties. The level of these difficulties was also another influential factor in determining the frequency with which students accessed the various resources identified here. Understanding these factors and how they can work together results in a heightened awareness of perceptions of social capital among sophomore level engineering students.

Some influential factors identified in the interviews were also mentioned in the end-of-term survey. Students indicated that availability and approachability were related to student use of both instructors and peer tutors. As was noted during interviews, students showed preference for peer tutors because students thought they were easier to relate to and were more available than the instructor during the in-class activities. The difficulty of the subject matter was also mentioned on the survey, and responses indicated that students seemed to utilize social resources less when the material was easier. They also said that in other classes, such as calculus and physics, which were seen as more difficult, social resources would be more important. In addition students recognized the importance of a positive classroom atmosphere and expressed a desire that their other classes have a similar atmosphere to the ones studied here.

## CONCLUSION

The findings in this study indicate that social capital is important for sophomore level engineering students and has various manifestations for different individuals and may be influenced by a number of factors. The identification of these influential factors during the data coding process described earlier improves understanding of resource transfer within student social networks and thus results in an increased understanding of the implications of social capital for sophomore engineering students. Even students who did not show evidence that they utilized many social resources when learning engineering mechanics did demonstrate a general awareness of the potential benefits offered by sources of information that could only be accessed through personal interactions with others.

Some students are more likely to utilize their peers and classmates or their friends as sources of information. Survey results support the interview findings and further indicate that peers serve as an important resource for sophomore engineering students. Other students prefer the instructor or the in-class peer tutors for assistance, and most use a combination of these resources. Student preferences for resources are affected by several factors, including the subject difficulty and the accessibility and approachability of the resources. In addition, the course instructor and the classroom atmosphere have the potential to influence student preferences which direct student choices in access to desired information.

As with any qualitative study, the findings here describe one particular set of students. It is important to consider the Principal of Proximal Similarity when considering the relevance of these findings to applications in other settings (Patton, 2002). The degree of transferability of these results depends on the similarity of other settings to the context of this research. If the two

settings are sufficiently similar when considering population, treatments, outcomes, and situations, the findings from this study may be applicable (Lincoln & Guba, 1985). It is the task of the researcher to assess the degree of congruity between studies so that transferability may be assessed. The students here were students at medium-size public universities with strong engineering departments and were enrolled in classes with instructors who are generally agreed to have a genuine interest in their students' success. Students chosen for interviews were purposefully selected to represent a broad spectrum of views on the helpfulness of the peer tutors and academic achievement, with the assumption that such a diverse group of students would have a high potential to yield various insights about access to peer tutors and other resources.

Findings in the current study indicate some of the social resources that students utilize and also identify several influential factors which help clarify student mobilization of these resources. However, further research is required to investigate the implications of each of these factors in more detail. For example, this study did not investigate the role that variations among instructors likely play in the access to various resources among students. It is possible that heightened inaccessibility of an instructor may reduce student use of the instructor as a resource, but may inspire increased information exchange between classmates who lack other options. Conversely, an approachable instructor may lead to stronger social links between the students and instructor, but relationships among students could decrease. A study including several instructors with various teaching philosophies could help shed light on the impact of the instructor on the social networks of students.

In addition to affecting student social networks, instructors also exercise a great deal of influence on the selection of the peer tutors. A study investigating the instructor's views on the role of social capital may also shed light on how peer tutors are selected, and thus how they can

serve as a resource for students. It may be that instructors select peer tutors who reflect their own views toward teaching which may influence their ability to serve as resources for students. Likewise, the variation among peer tutors and their attitudes regarding the importance of social interaction as well as their accessibility may prove an important factor in the presence of social capital among students. The tutors were not interviewed in this study, but future studies might also incorporate interviews with the peer tutors and course instructors as well as the students.

Future work might also develop a survey-based model to easily identify resources and influential factors in a generic engineering education setting. This would assist faculty and administrators to better evaluate the value of social capital for students and enable them to facilitate its further growth and development. This may also help identify new resources and factors which were not observed in this study that may be present in another setting.

Given the centrality of social networks to understanding social capital, future studies in engineering education applications of social capital might also include social network analysis. The detailed understanding of social connections that results from such analysis could help increase understandings of network connectivity and closure which has been shown to be intimately related to social capital (Lin, Cook, & Burt, 2001). The analysis of networks and network connectivity could help to provide a clearer picture of the various sources of information available to students while also determining the frequency with which these resources are accessed.

The academic engineering setting is one in which students rely on various resources to achieve the tasks assigned to them. These resources are largely accessed through social interactions. The use of such resources is not limited only to engineering students, but is

common in many fields including business. In education, it is important to promote meaningful interactions between students and a variety of other people including peers, instructors, and others. Social capital can provide one construct for shaping these interactions and investigating their implications among students.

The utilization of social capital can serve as an important contributor to the student academic experience. However, in order to fully appreciate the implications that social capital can have for sophomore engineering students, it is necessary to achieve a fuller and clearer understanding of what this means for these individuals. It has been the purpose of this study to identify student perceptions of social capital by determining available resources embedded in student social networks and the factors which influence their use. By learning more about these factors, the various members of the social networks and the connections between them can be better understood. And if students are to realize the full potential of social capital, it is crucial that educators and students recognize these resources and the relationships by which they are accessed.

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## APPENDIX A: INTERVIEW PROTOCOL

## INTERVIEW PROTOCOL

### *Guiding Research Questions*

1. *What aspects of the ICPT affect student attitudes known to be related to retention?*
2. *What aspects of the ICPT program encourage the development of student social capital?*
3. *How does student social capital relate to attitudes known to be related to retention?*

   A. *Openness, encouragement of discussion, and sense of discovering things together in classroom setting*
   B. *An in-class environment in which discussion and interaction are commonplace and students perceive a supportive learning environment.*
   C. *Resources embedded in social structure which are accessed and/or mobilized in purposive actions.*

### *Interview Protocol*

***Talk about your experiences at WSU in engineering in general***
*What academic resources are available to you as an engineering student?*
*What are the barriers to doing well in your engineering related classes?*
*What do you need to do well in these classes?*

**Remember to be sure to ask all questions marked with an asterisk during each interview.*

How are classes going?
*Do you ever have any problems in any classes? With completing homework, understanding topics, studying, etc.?
- What kind of problems do you have, in general?
- Have you ever come across any barriers to doing well in your classes?
- Have you ever found anything that impedes learning?
- What resources do you think could be provided to help you to overcome these obstacles?
- Which is most useful? Why?

*In what way is the department supportive of your learning?
- In what way is the department supportive of you academically? (i.e. do you think they want you to succeed during your academic career here?)

Do you ever have questions that remain unanswered during class on homework or concepts? What **resources** are available to you to use to solve these questions?

*Assuming a professor is a resource, are there other resources that are available to you?
- How would you define resources?
- Do you think that instructors are a good resource to help you learn/understand the material presented in class? Could you give an example of why you think that?
- Who do you go to in order to succeed at a particular class if you are having trouble on your own?
- Do you think that other students are helpful to your learning?
- Who helps you study or complete assignments? Peers, instructors?
- If peers don't help you, why not?

***Experiences in this class (statics)***

*Is there a supportive environment (for this class)?
Are there particular experiences that were supportive of your learning in this class?
Instructors? Students in class? Friends out of class?

*Talk to me about the instructor for this course.
Do you normally understand concepts when they are explained in class? If not, how do you go about understanding them? Talk to teacher or other resources?
If you need help with homework, what do you do? (ie. who helps you?)

***Experiences with Peer-Tutoring [describe program if not done before]***

*How does the peer tutoring program work? Could you explain/describe it as if you were talking to someone who was not in engineering?
*Could you talk about an experience you had with the peer tutors?
What questions were they able to answer for you?
Why was the tutor so important in this instance?
How did they help?
Could they help in a way that the professor could not?
Are you more efficient when the tutors help you?
Do they speak a different language than the professor does?
Do you think that peer tutors are different than typical TAs?
Could you think of any class where peer tutors would not be helpful?
*Earlier we spoke about resources, do you think that tutors are a good resource?
How often do you use the peer tutors for help on homework, studying, etc.?
Do the peer tutors in general provide good insight for understanding concepts and solving problems?
*Would peer tutors be good in some of your other (i.e. math and science) classes?
What is the most striking example of a class that could benefit from peer tutors?
How could they have helped you in that class?
What would your reaction be if we said that all freshmen will have peer tutors in their math, science, and engineering courses?
If you were trying to convince a friend to come to WSU and study civil engineering because of this peer tutor thing, what would you tell him?
What is particularly helpful about the peer tutoring program?
What are problems you have encountered with the peer-tutoring project?
Have you ever heard anyone make any negative comments about the peer tutoring program?
Space
Peer-tutor students
Instructor
Class content
What role do PTs play in the curriculum?

*Does the peer tutoring program influence whether or not you will stay in the field of engineering?
*Does the peer tutoring program help you to identify with the civil department? College of engineering/field of engineering beyond the university?
What role do courses (in general) play in developing an identity with college? The profession of engineering?

## APPENDIX B: MID-TERM SURVEY

# Statics Survey

Thank you for taking time to fill out this survey. Your responses are greatly appreciated. Your input is valuable to us because it will help the engineering department and Washington State University better understand how to assist engineering students in their educational endeavors.
*Directions: Please place an "**X**" in the box that best represents your answer to each of the following questions.*

**1 To what extent do you agree or disagree with the following statements?**

**(a) "The peer tutors have been helpful to me in this course"**
- □ Completely agree
- □ Somewhat agree
- □ Neither agree or disagree
- □ Somewhat disagree
- □ Completely disagree

**(b) "I have learned more in this course because of the peer tutors"**
- □ Completely agree
- □ Somewhat agree
- □ Neither agree or disagree
- □ Somewhat disagree
- □ Completely disagree

**(c) "I wish that my other engineering courses used peer tutors"**
- □ Completely agree
- □ Somewhat agree
- □ Neither agree or disagree
- □ Somewhat disagree
- □ Completely disagree

**(d) "The peer tutors did *not* add any value to this course"**
- □ Completely agree
- □ Somewhat agree
- □ Neither agree or disagree
- □ Somewhat disagree
- □ Completely disagree

**(e) "The peer tutors were able to answer my questions"**
- □ Completely agree
- □ Somewhat agree
- □ Neither agree or disagree
- □ Somewhat disagree
- □ Completely disagree

**(f) "My performance in this course was improved because of the peer tutors"**
- □ Completely agree
- □ Somewhat agree
- □ Neither agree or disagree
- □ Somewhat disagree
- □ Completely disagree

**(g) "The peer tutors want me to do well in this class"**

□ Completely agree
□ Somewhat agree
□ Neither agree or disagree
□ Somewhat disagree
□ Completely disagree

**(h) "The peer tutors have gone out of their way to help me"**

□ Completely agree
□ Somewhat agree
□ Neither agree or disagree
□ Somewhat disagree
□ Completely disagree

**2 What is your current major?**

_____

**3 What is your current age (in years)?**

☐☐

**4 Please indicate if you are:**

☐ Male

☐ Female

**5 What do you expect your overall GPA to be this semester?**

□ 4.0 or above
□ 3.50 -3.99
□ 3.00 -3.49
□ 2.50 -2.99
□ 2.00 -2.49
□ 1.50 -1.99
□ 1.00 -1.49
□ 0.50 -0.99

**6 What racial or ethnic group do you identify with? Please choose only one.**

□ Native American or Alaska Native
□ Asian or Asian American
□ Pacific Islander or Native Hawaiian
□ Black or African American
□ Hispanic or Latino
□ White (non-Hispanic)
□ Multiracial (please specify):

_____

□ Other (please specify):

_____

**7 What are the last 4 digits of your WSU student ID number (*for administrative purposes only)?***

☐☐☐☐

**8** **In what ways did the peer tutors help you this term?**
**(*Please write answer in the box below).***

_____
_____
_____

**9** **How could the peer tutors have been more effective helping you?**

_____
_____
_____

**10** **What were some areas of this class that were difficult for you?**

_____
_____
_____

**11** **How were peer tutors helpful in overcoming these difficulties?**

_____
_____

**12** **In what ways was this class supportive of learning?**

_____
_____
_____

**13** **Describe the difference between help from the peer tutors and help from the course instructor different?**

_____
_____
_____

**END OF SURVEY-THANK YOU!!**

## APPENDIX C: END-OF-TERM SURVEY

# Statics Survey

Thank you for taking time to fill out this survey. Your responses are greatly appreciated. Your input is valuable to us because it will help the engineering department at Washington State University better understand how to assist engineering students in their educational endeavors.
*Directions: Please write your answer to each question carefully and neatly in the space provided.*

1. Do you wish other classes were structured in a way more similar to statics? – Which aspect of statics do you wish could be implemented on other classes?

   _____
   _____
   _____
   _____

2. What are some strategies you use in other courses to conquer challenges that you encounter?

   _____
   _____
   _____
   _____

3. If peer tutors were implemented in another course, which course would you choose and why?

   _____
   _____
   _____
   _____

4. What can tutors do that professors cannot do for you as a student?

   _____
   _____
   _____
   _____

5. If you did not think that peer tutors were beneficial to this class, why not?

   _____
   _____
   _____
   _____