MATHEMATICS FACULTY AND STUDENTS: MENTORING AND THE DOUGLAS MODEL

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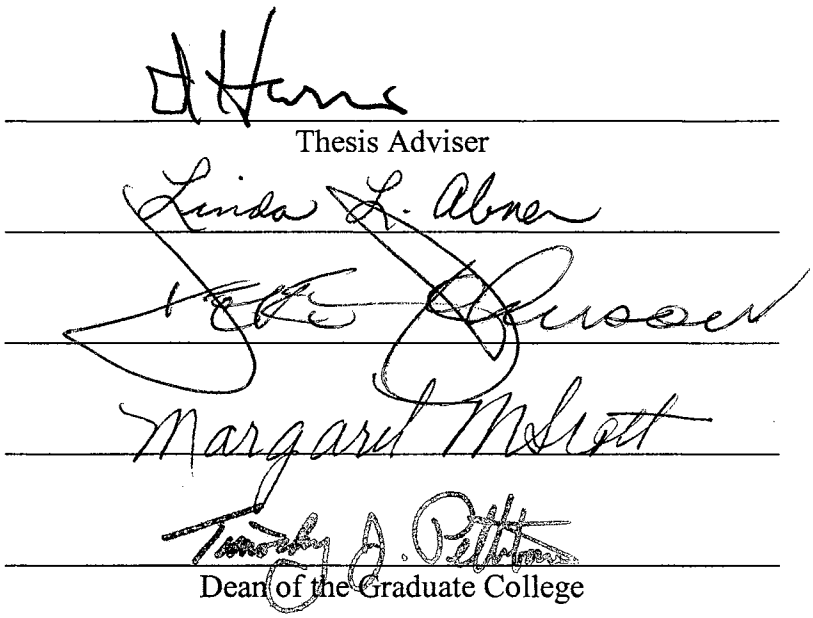

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CHAPTER I

INTRODUCTION

Traditionally, mentoring involves an apprentice learning from a master in a one-to-one experience. During the industrial age, mentoring focused on career advancement within organizational hierarchies (Haney, 1997). The wide array of circumstances in which mentoring can occur for undergraduates is in large part a reflection of the complexities of the subsequent information age. Consequently, the mentor and the mentee may take on a variety of roles under a variety of conditions and complexities. There are however, some predominant emergent characteristics in the student-professor relationships.

There are studies that suggest that individual students and professors from diverse backgrounds differ in their concepts of mentoring, how it occurs, and which higher educational arenas it occurs in. Diversity not only characterizes the modern setting in which colleges and universities find themselves, but it is often an aim of higher education. The modern university undergraduate is no longer typified by a particular race, sex, culture, or background (Kartje, 1996).

Mentoring undergraduate students is studied and depicted via a wide array of definitions and circumstances. Mentoring may be characterized as formal vs. informal. It may be aimed at high-risk students, career-oriented students, seniors or incoming freshmen. It may be one-to-one or one-to-many. The mentor may take on many

mentoring roles within these contexts. Some of these roles include guide, advisor, coach, motivator, facilitator, and role model (Galbraith & Cohen, 1995; Haney, 1997).

Further, such roles can be clarified according to two concepts for consideration, "intent" and "involvement" (Mertz, 2001). Mertz noted, as an example, that the level of involvement distinguishes role model from advisor. The role model relationship requires less involvement, while the advisor role requires somewhat more. Other clarifications in the research exist for distinguishing the roles of a mentor. In a study by Brenda Wilkins (2000), distinctions were made between coaching and mentoring. Unlike mentors, coaches are paid and do not give expert advice.

Head, Reiman & Thies-Sprinthall (1992) provide a more comprehensive identification of the mentor-protégé relationship. They describe, for example, a typology matrix created by J. Clawson (1980) with the degree of commitment and comprehensiveness of influence as continuums. The mentor is placed high in degree of commitment and high in comprehensiveness of influence. The authors go on to list mentor roles of development, symbolizer of experience, anthropologist, coach/supervisor, and trusted colleague. Phases of mentoring relationships are also outlined.

Just as many possible roles between mentor and mentee can exist, there is a range of diverse settings where mentoring takes place in colleges and universities. Mentoring between professor/teacher and student has been studied in community colleges and large urban universities as well as research institutions. The focus of research has been primarily on the power that is acquired by the mentees from the mentoring relationship (Patton, 1999). The intrinsic and extrinsic rewards associated with mentoring have also

been studied (Yeager, 2000), as have the developmental needs of students involved in mentoring (Mehlma, E. Glickauf-Hughes, 1994).

Both positive and negative outcomes are associated with mentoring. These outcomes involve the mentor, the mentee, the institution, and society at large. Some studies claim that the benefits of the mentor/mentee relationships are obvious (Kartje, 1997). Often, the aim of the mentoring process is to achieve positive outcomes, which can range from increased retention, academic performance and job satisfaction, to enhanced motivation and social and psychological adjustment. Other desired outcomes can be the achievement of diversity or the development of leaders (Battin, 1997). Possible drawbacks of mentoring include the inclusion of some while implying the exclusion of others, the sacrifice of the mentor's time, the required commitment on the part of mentor and mentee, and the inherent complexity of the mentoring process.

Statement of the Problem

Mentoring has been proven to benefit professional development and the overall teaching and learning environment in many settings. Mathematics is one area in which mentoring can be useful. Some mathematics groups and organizations have tried to stimulate more communication among mathematicians by holding social gatherings where professionals and students interact. The mentor-mentee relationship has been broadly suggested for student-professor relationships, and its proponents ascribe the many advantages inherent to this relationship (Howard & Grosset, 1992; Terrell & Hassell, 1994; Shulz, 1995).

However, although mentoring is recognized as important and necessary for student and professional growth, it does not occur in many environments. One reason for this is that some organizational environments may not be as suited as others for formal and informal mentoring to occur. Cultural theory may hold an answer to this dilemma.

Purpose of the Study

The purpose of this study is to investigate the mentor-mentee relationships of mathematics students and professors/teachers at two specific colleges. The focus is on the grid and group relationships in the context of the institutions in the larger social setting. In studying these relationships, the aim is to reveal how, according to the grid and group *typology* of Mary Douglas (1982), the organization of each institution inhibits or promotes the mentor-mentee relationships of the students and faculty.

Research Questions

1. What is the grid and group structure of each institution's mathematics setting for math students and math faculty and their interaction?
2. How is Mary Douglas's group/grid model useful in predicting mentoring relationships?
3. If there are differences in predictions and the research data, how can they be explained?

Conceptual Framework

The conceptual framework for this study is the grid and group typology elaborated by Mary Douglas (1982). The roles of mentors and mentees are conceptually fundamental to the study since many roles have been identified. The models of Mertz (2001) and Clawson (1980) enhance the analysis. Awareness of the importance of the philosophy and nature of mathematics is also important.

The Douglas model has a holistic aspect that is important in perceiving, assessing and comparing different social environments. The grid dimension refers to the degree to which the social environment constrains individual choices. The group dimension refers to the degree to which group relationships are valued. The relative strengths and weaknesses of these dimensions allow for an understanding of the beliefs and values inherent to a given social context.

The criteria identified by Douglas to analyze grid are control, competition, autonomy and insulation. Her criteria for analysis of group are survival/perpetuation, group allegiance, membership criteria, and life support. Further, according to Douglas, each of four biases—Bureaucratic, Corporate, Individualist, and Collectivist—that are associated with the four quadrants of the matrix represent unique ways of viewing, and thus interacting with, the world.

Figure 1 shows the four quadrants of the Douglas typology. The arrow indicates direction of higher group and higher grid.

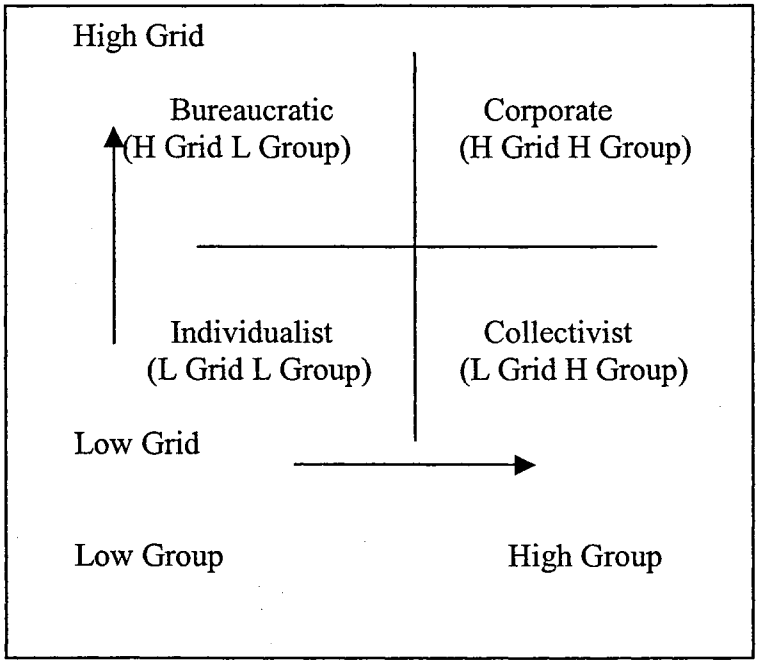

Figure 1. Mary Douglas's Typology of Social Environment

Methodological Design

The researcher is interested in understanding the viability and importance of mentoring in the cultural setting where the undergraduate student is mentee and the faculty member is mentor. Since the population to be studied is enclaved and well defined, the case study is appropriate. If one setting were to be analyzed, an instrumental case study would be appropriate (Stake, 1994); that is where "a particular case is examined to provide insight into an issue or refinement of theory" (p. 237).

The study involves two separate settings. Thus the "collective case study" approach has been chosen. The collective case study is the study of more than one case, as the extension of the instrumental case study. In this research, the larger issue or theory

is the grid and group structure of the settings and how they predict mentoring relationships.

Concern regarding the validity of the communication in the collective case study was addressed by triangulation. Denzin (1978) identified four basic types of triangulation: a) *data triangulation*—the use of a variety of data sources in a study, b) *investigator triangulation*—the use of several different researchers or evaluators, c) *theory triangulation*—the use of multiple perspectives to interpret a single set of data, and d) *methodological triangulation*—the use of multiple methods to study a single problem.

It is also noted that other researchers value another category of triangulation, *interdisciplinary triangulation*—triangulation involving two or more disciplines (Janesick, 1994). In this study, data triangulation was accounted for by conducting interviews with several student and faculty subjects from each setting. Interdisciplinary triangulation is also accounted for because anthropology, education, mathematics and the psychological and social aspects of mentoring as separate disciplines generally overlap in this study.

Yin (1994) recognized three types of case studies: *exploratory*, *descriptive*, and *explanatory*. This case study is the descriptive type, because the goal was to describe the mentor-mentee relationship and ascertain whether or not the Douglas model will predict the relationship. By contrast, the exploratory case study has the aim of defining the hypotheses for further study and the explanatory case study treats cause and effect.

Setting and Participants

The settings for the study includes two separate institutions of higher learning referred to as *College 1 (C1)* and *College 2 (C2)*. The participants in the study were mathematics faculty and the math majors at these institutions. The sites were selected on the rationale that the institutions would fall into different quadrants of Douglas's typology matrix and allow for fruitful comparison. Further, they represent a general variety of organizational contexts.

I established trust and rapport with appropriate representatives of the institutions being studied. I visited both campuses and discussed the study with the mathematics department chairs at both institutions

Further, I discussed the research with the director of research at *C2*. He informed me that I could begin interviews following IRB approval. At *C1*, I received the utmost cooperation in the identification of faculty members and students who participated in the study. The population for study consisted of 2 mathematics faculty and 2 math majors at *C2*, and 2 math faculty and 2 math majors at *C1*. The faculty and students at both were informed of the study.

The methods of inquiry and data collection are the *interview method* and the *questionnaire*. The questionnaire was informed by other case studies using the Douglas model. The interview was used as the method of inquiry for several reasons. One is that the number of participants was limited and manageable with this type of interview. Another is that the sites and respondents were chosen based upon their value to provide insight. The qualitative researcher must be attuned to the naturally occurring discourse

(Holstein & Gubrium, 1994). This cannot be accomplished with a questionnaire. The two can complement each other and account in part for triangulation.

Researcher's Bias and Experience

The student-professor relationships in mathematics have been key aspects of my experience in mathematics as a student, as a professor and teacher, and as a math organization developer. My understanding of mentorship has evolved through distinct threads of involvement.

One thread is the study of the philosophy of mathematics. There is no consensus among practitioners of a definition of mathematics. It does not fit in a neat definition. This is illustrated, for example, by Bertrand Russell and Alfred North Whitehead's attempt to base mathematics upon an logical axiomatic system around the turn of the 20th Century. It turns out that mathematics cannot be reduced to set theory.

Similarly it is arguable whether the objects of mathematics exist in the mind or in reality, or in both or neither. A related question is whether the body of mathematics, the theorems of mathematics and subject areas of mathematics have been invented or discovered. These can be important issues when our consideration is turned to relationships among people involved in mathematics. It will be important in interpreting the statements faculty and students make.

Over the past 13 years, I worked extensively with math clubs and student organizations. For the past 8 years I have served as a member of the Mathematical Association of America Committee on Student Activities (MAACSA), a national planning committee that meets annually in Washington, DC. This committee develops

and administers a variety of activities and opportunities for undergraduate students. These activities and opportunities are managed largely through fostering relationships between MAA student chapters and the mathematics department advisors.

Each year, the association holds and participates in two national meetings, one in the winter and one in summer. During both of these meetings, professional mathematicians and students give talks, plan, and socialize. I set up and run what is known as the Student Hospitality Center at these meetings. This is a location where several hundred undergraduate students in attendance can meet famous mathematicians, meet other aspiring mathematicians, or just relax a little, have refreshments and socialize.

I also originated and conduct the only college national mathematics championship, which is held annually at the winter meeting. Students participate with their math club advisors observing their efforts. Associated with the national championship is a mail-out and many preliminary competitions that are conducted and judged monthly at the local level. This mail-out goes to 400 college professors nationwide who serve as the facilitators for students who typically run and/or compete in the local competitions.

The national collegiate championship is held under the sanction of a society I formed, the American Society for the Communication of Mathematics (ASCM). ASCM was created to address the need to effectively communicate mathematics through symbols and through interaction with other students, teachers and professors.

ASCM also holds state high school mathematics championships in Georgia, Oklahoma, Texas and Florida. In addition, a state junior high/middle school championship is held in Oklahoma each year under the sanction of ASCM. All of this

outreach experience of connecting students with professors and other students who are interested in mathematics is balanced by my experience with local clubs and organizations.

For two decades, I have been involved directly on a local level with student math organizations in the form of a math club. During that time I served as advisor of math clubs at more than one university and thus have had the opportunity to witness the informal aspects of mentoring that were implicitly promulgated by my position. Similarly, over the years I have been a math student and aspiring mathematician taking part in the natural tendency toward mentee.

I have also been a college math teacher, teaching a variety of types of math courses and holding classes in which the number of student ranged from 10 or 15 to as high as 250. Altogether, I estimate that I have taught more than 6,000 students.

Through my activities with students—teaching, organizing activities, and advising—I have been particularly aware of student-professor relationships. I have served as sponsor for a residence hall floor. For two summers I was the director of the Summer Youth Academy in Mathematics on campus. As director, I selected and trained the students who attended the summer academy.

Another enriching experience involving informal interactions with students has been the presentation of free weekly seminars for students at a learning center on campus. These have been conducted every Monday afternoon for the past 10 years. Any student may participate. The seminars offer, on alternating weeks, the topics of calculus and algebra. For these seminars, I created a fun card game activity that encourages peer tutoring among the participants.

Whether securing meeting rooms for students, arranging banquets, or finding places to hold competitions, one factor stands out regarding the professor/student relationship. That condition is the implied dependency of the student on the professor. As an illustration, to a significant extent professors and teachers control the resources on campus. Students must seek the approval of the professional to use the university facilities. Professors and teachers have offices on campus while students typically do not. Professors and teachers typically have privileged parking while students do not. Professors and professionals make far higher salaries than student workers and thus have more disposable income.

Many researchers have identified this dependent relationship. It has been described as an "up-down" one (Hess & Sauser, 2001). Carrying over to the mentoring relationship, the student is thus subordinate to the professor with the professor remaining super ordinate. This sets the tone for the type of mentoring relationship that characterizes the university setting between student and faculty.

Not to be neglected are mathematical issues that potentially speak to the mentor-mentee relationship. How is mathematics as a discipline viewed by the respondents? An interesting question is whether these kinds of issues influence the way mentors and mentees relate to each other. The entirety of my experience involving mathematics will allow a meaningful understanding of perspectives in the analysis of the social settings under examination.

CHAPTER II

LITERATURE REVIEW

The purpose of this case study is to study the mentor-mentee relationships of mathematics faculty and students in college and to describe the relationship of grid and group to the settings where mentoring takes place. Therefore, the review of literature addresses the conceptual arenas of mentoring between professor and student. It also addresses limits and obstacles to mentoring, benefits and the downside of mentoring, mathematics mentoring, a definition/model of mentoring, and Douglas's (1982) grid and group model as the conceptual/theoretical framework for this study.

Professor/Student Mentoring in Higher Education

The literature on mentoring in education largely focuses on professional mentoring by senior teachers, of elementary and secondary teachers and instructors. More relevant to our topic, the mentoring of students in secondary education is well represented. A smaller part of the literature involves higher education mentoring.

In the literature on higher education, mentoring is divided similarly between the mentoring of new faculty and the mentoring of students. Mentoring of new faculty is quite different from mentoring of students. Mentoring of students by secondary teachers is more closely related to the topic of this study, which focuses on the mentoring of students by higher education faculty. There are, however, distinct differences between

these topics as well. Secondary teachers as mentors for students, for example, are a source of parallel academic learning because they sustain, support and expand the activities of instruction in the classroom (Orr, 1987). On the other hand, formal mentoring in the post-secondary setting between professor and student is most often used an in intervention strategy to support the continuing education of learners (Cohen & Galbraith, 1995).

When addressing the issues related to mentoring, there are naturally two parcels of discussion: the *mentee* and the *mentor*. In this study, the mentee as undergraduate student and the mentor as mathematics faculty are distinct. Each will be considered in turn in the review of the literature.

Since there is little in our education system that directly prepares a professor for the complexity of the mentoring process, of concern are the requisite skills, understanding and learning necessary on the part of professor mentor if the mentoring relationship is to be meaningful. A significant issue is whether the focus of the relationship is strictly upon mentee behaviors or whether it includes the role of the professor as mentor. *The Principles of Adult Mentoring Scale* (Cohen, 1995) examines the role of the professor in its assessment of the effectiveness of the mentoring relationship.

The scale is self diagnostic and has 55 statements that speak to the effectiveness of the mentor. Each statement begins with the pronoun *I* and assesses the person completing the scale. The 5-answer choice range from *never* to *always* assesses the overall effectiveness of a mentoring relationship and carries a weighted value from *1* to *5*. Further, the scale has sub-categories that are assessed. The sub-categories include a)

relationship emphasis, b) information emphasis, c) facilitative focus, d) confrontive focus, e) mentor model, and f) student vision.

The scale is important in its affirmation of the importance of the attributes and behaviors of the mentor. It is also important because of its use in determining whether effective mentoring takes place. The scale is relatively simple, and the attributes of the mentor where effective mentoring takes place can be gleaned from the simple structure of the statements and the corresponding scale.

Beyond the self-assessment of mentor behaviors and attitudes, some approaches focus on mentor characteristics through the viewpoint of the mentee as well. One such study, which considered 18 null hypotheses (Davis, 1989), analyzed whether the mentoring relationship existed in higher education between faculty and doctoral students at Texas Southern University, a traditionally Black university. Participating in the study were 13 advisors, 78 advisees and 39 graduated advisees. A survey and single-factor analysis were used to assess behaviors and attitudes of the mentors. The survey included a Likert type scale ranging from *1* to *7*. Students answered questions designed to assess both the attitudes and the behaviors of their advisors.

A separate part of the study asked professors to examine their own behaviors and attitudes. Interestingly, 100% of the advisors who were under examination considered themselves to be mentors to their doctoral students, while only 78% of the doctoral students considered their advisors to be mentors. The results of the study and the support of the null hypotheses affirmed that mentoring was taking place.

While studies of whether or not mentoring takes place can focus exclusively upon the behaviors and attitudes of the mentors, another potential focus of study is the

behaviors and attitudes of the mentees. In *A Training Guide for Mentors* (1999), Jay Smink noted that major goals of mentor programs include academic achievement, employment or career preparation, social or behavior modification, family and parenting skills, and cultural and social responsibilities. He noted that one way of determining the effectiveness of mentoring is to discern whether or not such goals are accomplished.

In *The Mentor's Guide*, Zachary (2000) also affirmed the idea of goals for mentees to be attained (p.94). He said learning "is the quintessential purpose of the [mentoring] relationship" and that what follows depends on clearly defined, desired learning goals. Zachary specified these goals as "mentee goals." He said the problem is exacerbated by the accountability factor associated with structured mentoring programs.

When goals for mentoring programs are stated largely in terms of mentee outcomes, the question arises of how the programs should be evaluated. Odell (1992) suggested that the evaluation of mentoring programs should depend upon the purpose of the evaluation so that a structured mentoring program would require some accountability in terms of outcomes. Odell said the assumption guiding what to evaluate should be "limited to the domain circumscribed by the stated goals of mentoring programs" (p. 97).

This illustrates a dilemma in professor/student mentoring relationships in higher education: The mentors' preparation and assessment processes are skewed toward setting goals for mentee performance outcomes. This can exacerbate an already existing problem of mentor preparation and the lack of a self-critical view on the part of the mentor. Cohen (1995) clearly identified this problem, stating, "...mentors may not always give high priority to the need to pursue information and specific training about the influence of the mentor.... Many professionals, therefore, enter the mentor role with their concerns about

improving the quality of the mentoring experience essentially tilted in the direction of observing and commenting on what students do" (p. 16).

Another, somewhat related problem concerns the type of mentoring that is to take place. It is related because the formal aspects of mentoring must address the success of mentoring as well as the success of mentee outcomes. Before considering the distinctions in terms for mentoring, the limits and obstacles to mentoring must be examined.

Limits and Obstacles to Mentoring

Mentoring is a complex process. It is therefore important that the context in which mentoring occurs facilitates growth. Relevant to mentoring in general, Reiman and Edelfelt (1990) presented several conditions that with their absence constrain growth of the mentoring relationship, or with their presence enhance its growth. These conditions are: 1) a feeling of reciprocity where both mentor and protégé communicate what they have gained from consultations, 2) a willingness by the mentor to model reflectivity and openness to inquiry, 3) an aptitude by the mentor for symbolizing abstractions in ways accessible to the protégé, and 4) the capacity to juggle a large number of tasks and responsibilities without becoming overwhelmed.

Smink (1999) said limits to mentoring are time, social distance, and isolation. In the context of higher education, both the availability and length of time are relevant to the process of mentoring. Smink contended that obstacles to mentoring are related to social distance, with social distance defined as mentor and mentee having differences in socioeconomic status, culture, generation, language or ethnic background. Relationships that have social distance are "difficult." Smink also found in interviewing mentors that

mentors "tend to feel alone without needed encouragement unless they are involved in a structured program ..." (p. 15).

Concurring on the importance of time in the mentoring relationship is Wunsch (1994), who views mentoring as a process in which "time commitment on the part of mentor and mentee appears to be a key ingredient" (p. 30). The limits and obstacles to mentoring play out in a variety of ways in higher education and become what may be considered barriers to mentoring. For example, one aspect of the university setting that differs from other aspects of our world is the way in which things happen in a strict sequence of time. Strict adherence to timelines, including the beginning and ending of semesters and required work that becomes necessary in a time schedule, can be a barrier to mentoring.

Another potential limit or obstacle to mentoring is the socioeconomic status of the faculty member, which is often quite different from the student mentee's. With the diversity of the student population, cultural differences are potential significant barriers to mentoring. The time required to complete one's education to become a faculty member in higher education suggests a generational disparity between mentor and mentee. All of these limitations to mentoring are potential barriers in the context of higher education faculty as mentors and students as mentees.

Another important aspect of some structured mentoring is problematic as well. It is the exclusionary nature of mentoring that is targeted for certain groups of students for their benefit. To address this problem, structured programs should be upfront in stating their goals but also should leave open the opportunity for all students to obtain mentors.

Sentiment against structured programs in favor of informal ones may be due to this problem.

Benefits and the Downside in Mentoring

The benefits in mentoring can be ascribed to the mentor, the mentee, the organization in which they are found, and the world at large. A variety of mentee benefits have been studied in the mentoring relationship between professor and student in higher education. Student satisfaction remains an important concern for college administrators, yet the needs of students are increasingly difficult to meet. This is due in part to the increasing diversity of students attending colleges and universities. A college or university can survive or fail based upon enrollments, and approximately 25-30% of the first-time freshmen who enter public, four-year college-level institutions do not return the second year (Moseley, 1999). Most universities employ student evaluations as a measure of student satisfaction and in an effort to make campuses more appealing to students.

Some studies indicate that student satisfaction is improved with mentoring. P. J. Boyd (1997) studied the mentoring relationship between faculty and undergraduate students and its impact on student satisfaction. The results of the study indicate that students who experienced a mentoring relationship with faculty expressed greater satisfaction with their college career.

Another dimension to the issue of student satisfaction is that of expanded opportunity for some groups of people. Gunn (1995) documented how mentoring can expand opportunities for those who have been traditionally hampered by organizational barriers, such as women and minorities, and how it can benefit their personal and career growth. Other studies suggest that mentoring can be appropriate for addressing the needs

of underrepresented, culturally and ethnically diverse populations on campus (Pantano, 1994; Higgins, 1998; Nelson, 1998; Cousert, 1999). In a study of college women, L. K. B. Higgins (1998) gave the *Multidimensional Self-Esteem Inventory* to 40 sophomore women, 20 of whom were in a control group. Statistically significant data showed that the self-esteem of women was positively impacted as a result of the mentoring experience. Five statistically significant characteristics emerged: a) global self-esteem, b) competence, c) lovability, d) body appearance, and e) identity integration.

Many researchers studying the effects of mentoring on minority students have concluded that the students benefit. Cousert (1999) studied the effects of mentoring first-year minority students who had been identified through the *College Student Inventory* as potential dropouts. Mentoring intervention for these students by faculty produced significant differences in grades, compared with a non-mentored group. No significant difference in grades was found to exist for Caucasian students so identified.

Maestas (2000) demonstrated, in a study of interaction outside the classroom, that mentoring activity with undergraduate minority students by faculty outside the classroom impacted student outcomes of grades and satisfaction. The impact depended upon the type of interaction experienced by the students. The study concluded by suggesting that different types of mentoring interaction should be designed to benefit selected groups of students targeted for mentoring, particularly Hispanic and Black students.

Researchers have devoted much less attention to the benefits derived by mentors from the mentoring process. Shulz (1995) suggested that mentors are "usually older and in midcareer. They are often at a point in life when they are reviewing what they have accomplished.... They gain recognition, respect, and satisfaction ... [and] a confirmation

of self-worth and acceptance as a result of the interaction" (p. 58). Shulz said the mentor can learn from self-examination and introspection. Other benefits to mentors include increased recognition and visibility, renewed meaning in their lives, and a fruitful blending of past experience and wisdom.

Wunsch (1994) said mentors should be compensated for their work. Compensation, she suggested, includes money stipends, release time, books, materials, student help, and computer time. She noted that most mentors receive no compensation for their work save the satisfaction of doing a good job. Compensation would be an expression of the recognition for the contributions that mentors make to the mentoring process, a processes by which the organization and the mentee largely benefit.

The benefits of mentoring to the organization are in part a direct result of the benefit to the mentee. The literature suggests that mentoring can improve the satisfaction, grades, and self-esteem of undergraduate students in selected student populations. These factors in turn affect retention and persistence in the university setting. Mentoring also creates a positive climate among faculty and students. Shulz (1995) elaborated that both organizations and society at large benefit from mentoring. She said mentoring maximizes human capacity to form attachments and that it blends with many theories of how adults develop and change through life. She noted that it puts people together who might not otherwise have had any contact with one another. By mentoring, organizations maximize the potential of their human resources.

Mentoring can have a downside in higher education as well. As mentioned earlier, questions of exclusion often arise when groups are targeted for mentoring as an intervention. Also, it has been noted that many professors are used to living a solitary life

of advanced study in a particular discipline and perhaps are not the types that are benefited by, or good at, mentoring.

Mathematics and Mentoring

Is mathematics mentoring different from other types of mentoring? If so, how? There is often disagreement about what mathematics is and consequently how it should be taught. For example, should students explore for answers in mathematics or should they be given the answers and have it explained how those answers came about? Are mathematics discovered or created? Much like the process of mathematics itself, such questions and statements are simply put, but difficult to answer. Saunders (1994) identified four main views of mathematics:

1. *Logicism*: All mathematical concepts can be ultimately reduced to logical concepts and all mathematical truths can be proved from these axioms alone.
2. *Formalism*: Mathematics is a game played with marks on paper, following rules.
3. *Platonism*: Mathematics is a body of knowledge waiting to be discovered.
4. *Fallibilism*: Mathematical knowledge is not absolute truth. It is open to correction and revision.

Saunders stated that in order for the mentor and mentee of mathematics to work together, the different views should be articulated. Therefore, it is important that mentors and students in higher education have shared views of mathematics.

This leaves to question, however, whether or not the mentors and students have been exposed to similar or different ways of viewing mathematics. Under the assumption that they have been exposed to different views, it seems a responsibility of the faculty mentor to address the issue of articulation of the ways of viewing mathematics. Alternatively, perhaps a more appropriate expectation would be for the mentor to minimally elaborate a shared view of mathematics to the mentee.

In a search of the literature, an activity that originated in Illinois is the only example located of mentoring in a special mathematics activity involving undergraduates and mathematicians. Beginning in the fall of 1996, undergraduates and mathematicians working in business, industry, and government were paired up in mentoring relationships with undergraduates of mathematics who were members of the Mathematical Association of America (MAA) Student Chapters. The project involved Ralph Czerwinski of Milliken University in Decatur, Illinois and John Haverals of Bradley University in Peoria, Illinois. The two mathematicians, who are faculty members and advisors for MAA Student Chapters at their respective colleges, secured a grant through the MAA two years ago. The grant was used to begin an Internet mentoring opportunity for undergraduate students who are members of the MAA.

The activity was begun by sending a brochure to mathematicians, who then responded by mail with appropriate information. A similar brochure was sent to students thorough their advisors in the Illinois Section of the MAA. The results were modest the first year. Czerwinski reported that many mentors signed up and only a couple of students responded. The students and mentors interacted through e-mail correspondence instead of through phone calls or letter writing. Students were encouraged to ask questions of their

mentors such as, "What math is used? How much math is used and how vital is it? What courses should be taken? What type of salary can be expected?" It was also suggested that the students might have a chance to contribute to an ongoing project or to problem solutions in some way. In subsequent years, the mentoring opportunity has been in place but inactive.

A Definition/Model of Mentoring

For the purpose of this research, consideration of a definition of mentoring will be necessary. Mentoring has been characterized in a variety of ways; *formal vs. informal*, *sponsored mentoring*, and *structured mentoring* are a few examples. Further, in the literature many terms such as *coach, advisor, patron, protector, benefactor, counselor, guide, role model, supporter,* etc. are sometimes taken to be synonymous with, if not confused with, mentoring.

Wunsch (1995) describes informal mentoring as a relationship relying on "personal selection, natural congruence, and happenstance" (p. 29). It is characterized as evolving slowly over time as pairs learn about and trust each other. In informal mentoring, mentors tend to control and mentees tend to be passive. In opposition to that, according to Wunsch, are structured programs sponsored by an institution. One advantage to this type of program is it identifies all of those who can benefit from mentoring. Wunsch is thus equating formal mentoring with structured and sponsored mentoring, an apt and consistent way of conceiving the term.

Other writers offer a variety of ways to view mentoring, most often tying it to a concept of career. This can be problematic in higher education with undergraduates being

mentored by professors, however. Many undergraduates do not know what career field they will be entering. Many professors are not very aware of career opportunities within their discipline, but rather simply the academic setting in which they find themselves.

Virtually every writer on mentoring has recognized the dilemma of defining mentoring related to a particular setting. Some have arrived at general characterizations that are too broad to be considered viable for study in a particular area. As an example, Golian and Galbraith (1996), after considering definitions from a variety of sources, defined mentoring as "process within a contextual setting; involves a more knowledgeable individual; provides professional networking, counseling, guiding, instructing, modeling, and sponsoring; is a developmental mechanism (personal, professional, and psychological); is a socialization and reciprocal relationship; and provides an identity transformation for the mentor and mentee" (p. 17).

An early attempt to describe mentoring based upon comprehensiveness of influence and degree of commitment was provided by Clawson (1980). The diagram in *Figure 2* represents the relationship. This diagram allows a variety of considerations to be placed in order based upon the two dimensions given, with the mentor relationship being depicted by high influence and high degree of commitment.

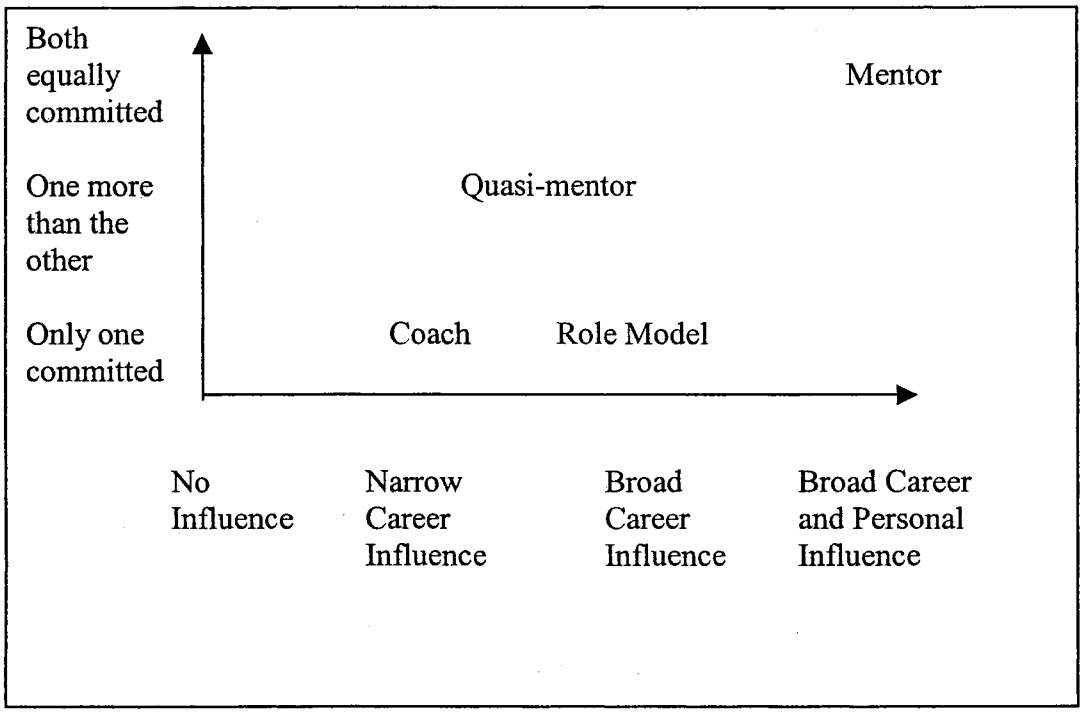

Figure 2. Clawson's Dimensions for Mentoring Relationship

This model indicates that mentoring is more than fulfilling functions. It is not strictly process and it is not strictly function. It is a blending.

Mertz (2001) contends with the array of terms. She noted explicitly that a definition of mentoring is particularly problematic for the educational setting. She pointed out the need for a distinction between advisor and mentor in addressing the problem. She created a definition for the academic context in particular. Rather than focusing on the two characteristics of commitment and influence, as did Clawson, she focused upon the two features, albeit different ones that she deems most salient, intent and involvement. *Intent* is "concerned with the aim and purpose for which an activity is undertaken, the outcomes or ends sought, the primary focus in the sense of being

preeminent, first among several." *Involvement* is about "how much is required of each party to the activity, emotionally and psychologically; the nature and level of investment, the intensity of the relationship" (p. 6).

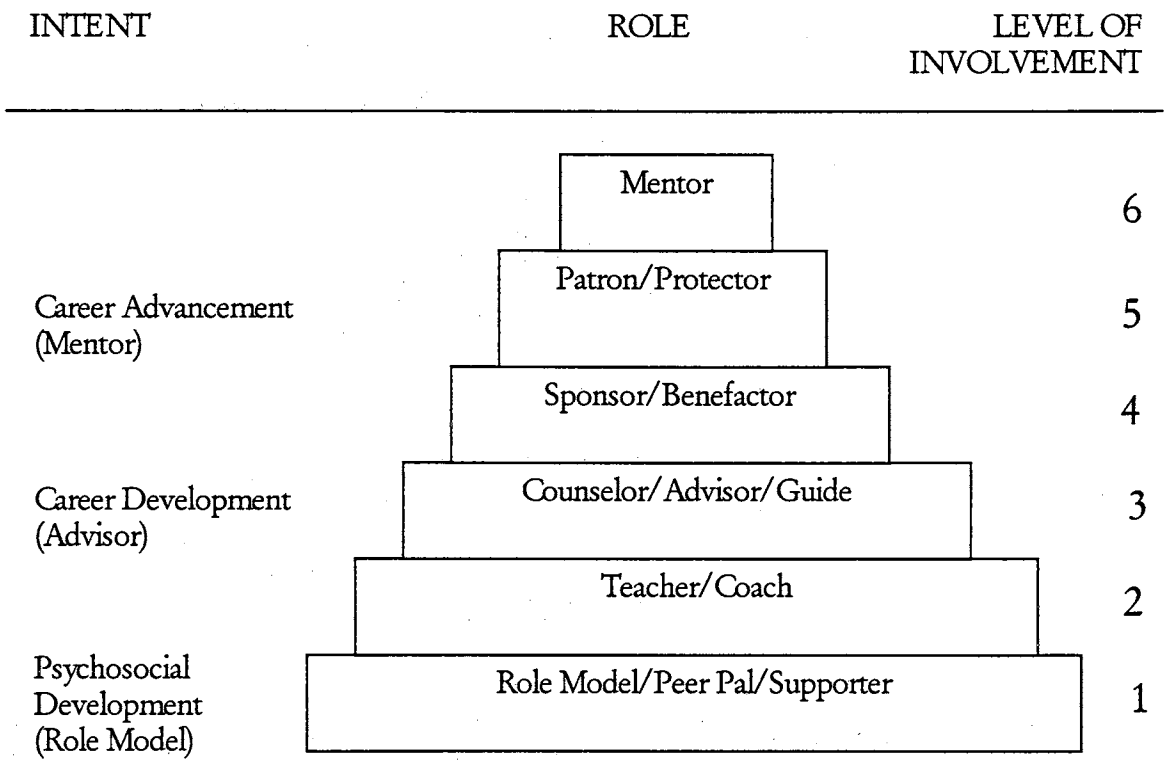

Figure 3. The Mertz Model for Mentoring

For the purposes of this research, the academic mentoring roles arranged hierarchically in terms of intent and level of involvement are considered most appropriate. The reasons for this are: a) the model is largely inclusive with basis of consideration the categories of intent and involvement; b) the model is designed for the higher educational setting; and c) the relationships studied are advisor/student relationships, asking whether mentoring is accounted for. The model clearly speaks to the latter reason, because Mertz (2001) clearly identified the distinguishing roles between advisor and mentor (see Appendix IV).

The Douglas Model

Mary Douglas's grid and group typology is the result of her attempt to classify groups of people and individuals. "Group means the outside boundary that people have erected between themselves and the outside world. Grid means all other social distinctions and delegations of authority that they use to limit how people behave to one another" (Douglas, 1982, p. 138).

Whereas the environment acts as a constraint in a social context, the grid and group analysis aids in examining what is apparent as people's values and beliefs are demonstrated. It is used as a lens to filter and analyze data relevant to a particular social context. The Douglas model allows consideration of "the total social environment and individual member interrelationships among each other and their context" (Harris, 1995).

Research using the Douglas Model

C. L. Boettger (1997) used the Douglas model to test its usefulness and to "examine site-based management in different cultural contexts in explaining site-based management in public school administration" (p. 3). After collecting data through interviews, documents, and observation, Boettger used a case study approach to aid in communicating the interrelationships of the social context. After the interview data were categorized and divided into units of data, these units were typed on index cards. They were then sorted for their appropriate category of grid and group with codes referencing the source.

The schools were selected purposively. The study concluded that the cultural climate of schools produced specific dimensions of group and grid when analyzed. Each site was categorized as a different cosmological type in Mary Douglas's model. In addition, it was concluded that the cultural climate at each site may have had an effect on implementation of a district's policy.

S. L. Diel (1998) used the Douglas model to examine the culture in rural schools and to try to gain insights into their success. A qualitative approach was taken in visiting four sites. Research targeted students, curriculum, faculty, parents, administration, community members and classroom settings. Also examined were interactions and associations of teachers and students inside and outside the formal learning environment. Each of four sites were classified in a different type according to the Douglas model.

J. H. Purvis (1998) used Douglas's model to study the retention of ethnic minorities in the field of education. The aim was to try to disclose potential reasons

people become teachers. Purvis noted that fewer ethnic minorities are entering college, entering education as a field, and staying in education as a field.

Purvis asked what changes in the teaching profession would create an environment conducive to the retention of teachers. Purvis compared cultural categories in white versus non-white teachers. Purvis determined that groups of Black and white teachers were almost "homogeneous based upon their responses" (p. 71).

Sherwood Lingenfelter used the Douglas model in his book, *Transforming Culture: A Challenge For Christian Mission* (1998). For missionary work, Lingenfelter recognized the importance of framing the Christian message in "language and communication forms meaningful to the local culture" (p. 12). He used the grid and group typology to illustrate the differences that can exist between cultures when Christian mission comes in contact with indigenous churches and culture.

The book ends with case studies from current and biblical accounts. Lingenfelter recognized the importance of cultural attributes as they can be identified in the grid and group typology. He made suggestions that speak to Christian practice based upon cultural differences.

Summary

The literature on mentoring in education addresses teacher-to-teacher, professor-to-professor, and teacher-to-student, and professor-to-student mentoring in both secondary and higher education. Professor-to-student mentoring can benefit the professor, student, and institution in several ways, many of which are related to benefits to the student. There are difficulties or downsides with mentoring that can prevent

mentoring from being a successful structured program. The literature on mathematics mentoring between undergraduate professor and students is very sparse. A modestly successful program involved mentoring via email as an activity sponsored by the MAA in Illinois.

There are many conflicting definitions of mentoring. The conflict is due in part to the many contexts where mentoring takes place. A problem is that a definition that fits all the contexts is too general for consideration in a particular setting. The Clawson Model (Figure 2) is an early attempt to sift the definitions to arrive at a succinct, workable definition for mentoring. The Mertz model, *Figure 3*, designed particularly for the educational setting, is most appropriate for this study. It addresses the distinction between advisor and mentor in relationships between students and professors in higher education.

Douglas's grid and group typology has been demonstrated in several studies to be useful in the educational setting. The model allows the researcher to examine and explore interaction and interrelationships in a social context accounting for both the individual(s) and the group(s). Patterns can be traced throughout the entire setting and the entire system under investigation.

CHAPTER III

METHODOLOGY

Introduction

This chapter describes the data collection procedures and methodology for the study. Qualitative, naturalistic inquiry was chosen because the research involves coming into contact with verbal, visual, and sensory accounts of intact culture. The objective of the research was to portray the culture of the mathematics department at two institutions of higher learning. The research was exploratory, asking whether the typology of Mary Douglas will predict mentoring. The case study was instrumental according to Stake (1994), and it was descriptive according to Yin (1994).

Data Collection

Arrangements for the Study

Prior permission was granted from the lead research administrator from each institution to be on campus for the purpose of doing the research. After IRB approval was granted, a letter was sent to each of the officials. A math department faculty member was designated at each site to make contact with the faculty and students who would be participating in this study. They were notified so the researcher would be in contact with them to set up an interview. Interviews were conducted at sites convenient for the

subjects. All faculty met in their offices. Three students met in the library and one met in a lab area.

Sites and Subjects for the Study

Eight subjects participated in the qualitative study. Participants in the study included 2 math faculty members and 2 undergraduate math major students from a small, remote, private suburban university designated *C1*. Also included were 2 math faculty and 2 math major undergraduate students from a medium-sized, public metropolitan community college designated *C2*. These designations were used to conceal the identity of the colleges. Originally, 10 subjects were slated to participate in the research, with 4 at *C1* and 6 at *C2*. However, a faculty and a student from *C2* were excluded from the study because the faculty member had not been in contact with the student designated as his or her advisee.

Designations for the faculty will be *F1C1, F2C1, F1C2* and *F2C2*. Student designations will be *S1C1, S2C1, S1C2* and *S2C2*. Importantly, the sampling for this qualitative study was purposive. Purposive sampling is central to naturalistic inquiry since the main concern is the discovery of patterns (Earlandson et al., 1993). *C1* and *C2* were both selected purposefully based upon distinct differences and observed attributes by which they might be typed differently in the Douglas typology. Faculty and students were deliberately chosen in pairs, with each faculty member being the advisor for a specified math major student.

By circumstance, an exception occurred with *F1C1* and *S1C1*; *F1C1* was not the assigned advisor for *S1C1* but informally served so in many respects. Because of having a double major, *S1C1* was formally assigned an advisor who was outside the mathematics

department. Therefore, *F1C1* was the faculty representative associated as an advisor for *S1C1*. In addition, *F1C1* and *F2C2* were the only math faculty at the institution, while *S1C1* and *S2C2* were the only math majors.

Documents and Questionnaires for the Study

Documents related to *C1* and *C2* were studied. These documents included current information about *C1* and *C2* as well as some historical information. Current brochures, brief histories, messages from officials, and other descriptive materials were obtained from each institution. The documents were obtained through the office of public affairs at each institution.

A questionnaire to be filled out by faculty was designed to help in classifying the math departments at the respective institutions according to the Douglas model (see Appendix I). The questionnaire allows for a tally scoring a single positive or negative point for each statement completed by the faculty member. Nine questions scored positive or negative grid. Nine questions scored positive or negative group. The total for each subject and each site was totaled to allow a positive or negative value for group and a positive or negative value for grid.

Interview Questions for the Study

Interview questions were asked of students, and a different set of interview questions were asked of faculty. The same initial interview questions were asked of students and the same initial interview questions were asked of faculty (see Appendices II and III). The interview questions were open-ended, with the respondents encouraged

elaborate on the answers. An additional question was asked of the respondents occasionally to seek clarification of a position or elaboration on an answer to a prior question. Often, the researcher used the method of nodding his head in a positive way, in effect affirming to elaborate in an area.

While the questionnaire was designed explicitly for the purpose of typing the math department setting in terms of the Douglas model of grid vs. group, the open-ended interview questions were designed to investigate mentoring as well. The last interview question asked of each subject was, "Define mentoring." Each interview session began with discussion of some brief background information and the purpose of the research. The sessions were taped on a recorder and transcribed verbatim afterward. The transcriptions are contained in a Microsoft Word document on a personal computer with all references to individual persons removed. The interview data are grouped according to institution and paired according to faculty-student relationship.

Observations

The researcher is familiar with each institution. The researcher has attended many functions with *C2* over the years, including judging for a local math competition and meeting with faculty. The researcher is also familiar with *C1* over a long period, i.e., with the faculty and interactions in the math department. These may be considered unstructured observations (Earlandson et al., 1993). For more structured observations, the researcher was invited to attend the open house events welcoming prospective students to the college in an all-morning event at *C1*. The researcher sat at the math department booth. The researcher also attended classes given by *F1C1* and *F2C1* and observed the

interaction and structure of the classes. The researcher also has attended meetings with some of the faculty at *C2*. During these meetings, curriculum matters for the coming year were discussed.

The researcher is also a keen observer of phenomena, in that the researcher has taught the courses that were being taken by the student subjects and being taught by the professor subjects. The researcher has held a similar position at another institution of higher learning and has taught similar students.

All of these aspects of the researcher's experience and interaction prepares the researcher for *critical incident* analysis. A critical incident has two characteristics: a) it is a specific event occurring in the social context being studied that b) reflects critically on the operation of that context (Earlandson et al., 1993). These can be used to "effectively communicate the essence of the organizations" (Earlandson et al., 1993, p. 106).

Naturalistic Inquiry and Trustworthiness

Naturalistic inquiry involves some techniques that provide trustworthiness (Earlandson et al., 1993). *Prolonged engagement* involves learning about the culture under consideration over a prolonged period of time. Prolonged engagement was utilized in this research because the researcher has a long history of engagement with each institution. Furthermore, the researcher made several visits to conduct interviews under a variety of conditions. Some of the interviews were postponed due to a variety of situations and were rescheduled. In addition, the researcher made advance contact with each institution, discussing the research with their lead administrators. The researcher

attended a variety of meetings at each institution prior to the beginning of the research, creating rapport with the participants.

Persistent observation involves the seeking out of "sources of data identified by the researcher's emergent design" (Earlandson et al., p. 136). Persistent observation in this research is demonstrated, for example, by the researcher collecting information about a mentoring program available at the *C2* not formally participated in by the faculty interviewed. Also at *C2*, the Upward Bound program and mentoring were mentioned and follow-up information was gleaned. At *C1*, *S2C1* was later observed in the office area of *F2C1* working with some of the puzzles in *F2C1*'s office. Other information was collected from *C1* after the interviews as related to the *C1*'s traditions.

Triangulation is important in credibility of the naturalistic study. It uses several kinds of methods or data (Janesick, 1994). Data triangulation was evidenced when all of the interviews were scheduled separately. One was scheduled on a weekend, and others were held on odd days of the week and whatever times the participants' schedules would accommodate. Each campus was visited during both morning and afternoon. In addition, the questionnaire uses quantified information and was administered independently of the interview process. Theoretical triangulation is accounted for since the occurrence of mentoring will be first analyzed using the Mertz model and confirmed according to the Clawson model.

Lincoln and Guba (1985) suggested that each piece of information should be expanded by another source to improve trustworthiness. Each university was typed in the Douglas model by using the questionnaire, interviews, observation, and documents. The

mentoring aspects of the institutions were examined using interview, observation, and documents.

The researcher self-audited by describing the meetings at each institution. In addition, the obtaining of the interview questions and the questionnaire were recorded by the researcher making sketchy notes at relevant periods during the process of research using a reflexive journal to log encounters.

Data Preparation

After transcribing the interviews into writing, the writing was divided into units representing independent thoughts, typically sentences. If however two or three sentences were essentially the same thought, they were organized as one unit. The number of response units for each subject varied from a low of 57 to a high of 120. The response material from interviews was divided into these units. Each unit represented an independent thought and spaces were placed between them. Three copies of the typed units for all subjects were created.

The questionnaires were examined. The questions and responses were separated by grid and by group. The questionnaires were marked according to the key. No other preparation was necessary with the questionnaires.

Summary

This chapter contained discussion of the methodological design for the study. The questionnaire and interview questions were listed in appendices and documents examined were noted. The way the data was acquired and prepared was discussed.

CHAPTER IV

DATA PRESENTATION AND ANALYSIS

Selection of Participants

C1 and *C2* were chosen for the study due to their distinctly different cultures. Lead administrators in each mathematics department were asked first if their department had students who were math majors. Next, the advisor for each of those students was identified. The lead administrator notified each of the advisors if they would be willing to participate in the study. Two faculty responded from *C1* and three faculty responded from *C2*. There were only two math majors at *C1* and two faculty members. One faculty member at *C1* served as an advisor for *S1C1* with the other serving essentially as an advisor. At *C2*, three students and three corresponding advisors were identified. One of the faculty members at *C2* had no contact with the student advisee so that pair was excluded from the study. The final selection involved two students and two faculty members from *C1* and two students and two faculty members from *C2*.

The students at each college and their math advisors were chosen as the advisor-advisee relationship is the most demonstrable, closest formal relationship at each institution. In addition, according to the Mertz model for mentoring, clear distinctions were made between advisor and advisee. The researcher anticipated these would allow

for a decision of whether mentoring was or was not happening in the selected pairs with the advisor-advisee relationship.

Case Narrative Introduction *C1*

C1 is a Roman Catholic University. Its roots trace back to Benedictine Catholic Education, a 1,500-year-old tradition. The current grounds were occupied by missionaries during the middle to late 19th Century. Occupation has evolved over the years from a girls' school to a two-year college a couple of years ago, evolving to its present status as a four-year institution of learning. It is relatively isolated, located approximately 30 minutes from a large metropolitan area, lying on the outskirts of a relatively small community. Ninety percent of the students that attend *C1* receive financial aid.

The university can be characterized as a Christian community of learning. It reaches out to Catholics and other faiths that value the opportunities that *C1* offers. The mathematics department at *C1* is largely support oriented, offering courses for majors other than mathematics. The math major, a new major at the institution, started a couple of years ago.

The math classes at *C1* are small with 12-15 students in each class. The lectures are a blend of lecture and personal interaction through student participation. Students make presentations in math classes at *C1* as part of the mathematics curriculum. The faculty and students are friendly and have a calm, polite demeanor both in and out of class. An air of trust is obvious as one walks the grand halls of the old administration building where the math classes are held.

Math classes are held in rooms on the fourth floor of the marquee building on campus. This is the same building where prayer services are held each week for those who want to attend. On another floor of the building, an expansive library is housed, of easy access to students in the building.

Case Narrative Introduction *C2*

C2 is a two-year state community college founded in the mid-seventies. It is located in a large metropolitan area serving a large number of diverse students. New graduates of state high schools receive tuition waivers to attend. *C2* promotes student success through access and quality. *C2* has distance programs, lots of evening classes, and other opportunities making it both traditional and non-traditional.

The mathematics department is largely support oriented, supporting required course work for a variety of majors. Nevertheless, each year there are a few students who major in mathematics. Most of the math majors have in mind transferring to another institution of higher learning to complete a mathematics related degree. The mathematics faculty offices at *C2* are open, divided only by low partitions, so that other people are visible across the room. Faculty and students engage each other regularly in formal and informal circumstances. Classes are busy and students bustle from here and there walking along long corridors to and from classes and parking facilities. Classroom instruction uses modern technology. The math lab features computing equipment and open areas to serve many students.

Use of the Douglas Model

The purpose of this study was to determine the usefulness of the Douglas model in predicting mentoring. The Mertz model for advising was selected in examining mentoring because of the appropriateness and inclusiveness of the dimensions and its addressing of mentoring in higher education, and for the distinctions that are recognized between advising and mentoring. It was presumed in these settings that the advisor relationship was met in each pairing of faculty and student and that the mentoring relationship could be identified by characteristics listed by Mertz that separates advising from mentoring.

The cultures at *C1* and *C2* were typed using the Douglas model. Interview data were analyzed using a technique suggested in Earlandson, et al. (1993). In earlier studies (e.g., Harris, 1994) the Douglas model was used a posteriori in an effort to demonstrate the usefulness of the Douglas model. In the current study, the Douglas model is used a priori since the research is concerned more directly with the particular aspect of mentoring and since research such as that of Harris (1994) illustrated the usefulness of the Douglas model in typing educational culture.

On the first of three transcription copies, in the first round of the interview analysis, each of eight interviews were analyzed. Each unit was determined to be low grid, high grid or neutral and marked accordingly. High grid units were marked with a plus. Low grid units were marked with a minus. Any unit that did not correspond to grid analysis was unmarked and was counted as neutral to grid. Some units were marked with a plus and a minus meaning they were both high and low grid. These were labeled as

duplicates. Some units that spoke very conclusively and were telling to high or low grid, were marked with an asterisk.

Next, with a second copy of interview transcriptions, each unit was determined to be high group or low group. Particularly telling units that spoke to high or low group were identified and marked for future reference. These were analyzed for *C1* and *C2*.

Analysis of the questionnaire simply involved a matching with the key that is in Appendix I. Each response to nine of the eighteen questions was recorded as high grid or low grid. Each response to the remaining nine of eighteen questions was recorded as high group or low group.

Examining Mentoring Using the Mertz Model

With a third copy of the interview transcriptions, a similar process was conducted for mentoring. Importantly, since the faculty represented the advisor for the student, only the separation characteristics or conditions from advisor to mentoring were examined. If a unit demonstrated that the condition beyond advising was met based upon the distinctions in the Mertz model, it was marked and noted with a plus. If a unit demonstrated that the condition for advising was excluded, a minus sign was assigned. The criteria for conclusively was based upon the context of understanding of intent and involvement of the subjects and meeting the conditions of the Mertz model for mentoring. The conditions were numbered and the unit was labeled with the appropriate condition being met for future reference. If a unit was irrelevant to the Mertz model conditions, it was left unmarked.

Researcher's Discernment

Throughout the analysis of the interviews, from the division of the transcripts into units to the judgment regarding each statement, researcher discernment was used. Discernment involved the nature of the mathematical and educational context. Informed researcher discernment was also used in typing the units under consideration of the Mertz and Douglas models.

Setting and Subject Characteristics

Table 1 provides select characteristics of the subjects and the math departments at each site. The title of the faculty member is given along with number of years at the respective institutions. The student classification is similarly provided. Age and sex are provided along with the relationship between student and professor. The student advisee is listed below each corresponding faculty member.

TABLE 1

CHARACTERISTICS OF SUBJECTS AND MATH DEPARTMENTS

	Faculty/Student	Years at Institution including current year	Age	Sex	Relationship
	C1: There are 2 full time mathematics faculty and 2 math majors.				
F1	Instructor	2	37	M	Designate Advisor
S1	Student Math Major	junior	20	F	Designate Advisee
F2	Full Professor	5	55	M	Assigned Advisor
S2	Student Math Major	sophomore	20	M	Assigned Advisee
	C2: There are 13 full time mathematics faculty and 12 math majors				
F1	Full Professor	6	43	F	Assigned Advisor
S1	Student Math Major	sophomore	31	M	Assigned Advisee
F2	Full Professor	14	55	F	Assigned Advisor
S2	Student Math Major	sophomore	28	F	Assigned Advisee

Research Questions

Research Question 1

In answering research question 1, "What is the grid and group structure of each institution's mathematics setting for math students and math faculty and their interaction?" two instruments were used. They were interview questions asked of both students and faculty and a questionnaire filled out by faculty. The interview questions asked of both students and faculty allowed for the elaboration of answers by the

respondents. The two instruments, interview questions and questionnaires, were administered separately using different methods.

Research Question 2

In answering research question 2, it is noted that an assumption has been made in this study that the advisor-advisee relationship is examined to determine whether mentoring takes place. This assumption is important in analyzing the data to determine whether a mentoring relationship exists between the advisors and advisees. This assumption is also important as it allows the researcher to examine the characteristics of the Douglas model in high grid/high group and low grid/high group to examine whether the characteristics of each might influence whether mentoring exists beyond the advisor-advisee relationship.

Research Question 3

Research question 3 was answered based upon the results from research question 1 and research question 2.

Presentation of Data

Interview transcription data analysis using the Douglas model will be presented first followed by questionnaire data using the Douglas model. Interview transcription data analysis using the Mertz model and the addressing of mentoring will follow.

Interview Data and the Douglas Model

For the four subjects in *C1* and the four subjects in *C2*, the interview transcriptions were divided into units that stood as separate thoughts or ideas. The tally for each subject is noted in *Table 2* with total units representing the entire interview excluding the subject's definition of mentoring. Variation in the number occurred in part due to the openness of the research questions, allowing the subjects the freedom to give short or lengthy answers to questions.

TABLE 2

UNITS FOR EACH SUBJECT

C1 Subject	Total units from interview transcriptions as independent thoughts for interview questions excluding the definition of mentoring.
F1C1	63
S1C1	68
F2C1	92
S2C1	87
C2 Subject	Total units from interview transcriptions as independent thoughts excluding the definition of mentoring.
F1C2	120
S1C2	67
F2C2	67
S2C2	57

From a printed hard copy of the interview transcriptions, each unit for each subject was analyzed separately to determine a rating of high or low grid. If a unit was determined to be high grid, it was marked with a plus. If a unit was determined to be low group, it was marked with a minus. If a unit had both high and low group interpretation, it was marked with a plus and minus. The number of these duplicates is listed for each subject under the column "Total units" in parentheses. A total grid number was determined for each subject. The results of the analysis and computations are provided in *Table 3*.

For each subject, *Table 3* gives total units and duplicates, total positive grid from the units tally and total negative grid from the units tally. The total grid value is determined by the computation for total positive grid and total negative grid taken together.

TABLE 3

GRID FROM INTERVIEW TRANSCRIPTIONS

C1 Subject	Total units	Total positive grid	Total negative grid	Total grid
F1C1	63 (3 dup)	+43	-11	+32
S1C1	68 (1dup)	+15	-6	+9
F2C1	92 (1dup)	+16	-6	+10
S2C1	87 (3 dup)	+27	-16	+9
C2 Subject	Total units	Total positive grid	Total negative grid	Total grid
F1C2	120 (6 dup)	+23	-46	-23
S1C2	67 (5 dup)	+10	-28	-18
F2C2	67 (2 dup)	+8	-30	-22
S2C2	57 (1 dup)	+6	-17	-11

Next, from a second printed hard copy of the interview transcriptions, each unit was analyzed separately to determine a rating of high or low group. If a unit was determined to be high group, it was marked with a plus. If a unit was determined to be low grid, it was marked with a minus. If a unit had both high and low group interpretation, it was marked with a plus and minus. The number of these duplicates is listed for each subject under the column "Total units" in parentheses. A total group number was determined for each subject. The results of the analysis and computations are provided in *Table 4*.

For each subject, *Table 4* gives total units and duplicates, total positive group from the units tally and total negative group from the units tally. The total group value is determined by the computation for total positive group and total negative group taken together.

TABLE 4

GROUP FROM INTERVIEW TRANSCRIPTS

C1 Subject	Total units	Total positive group	Total negative group	Total group
F1C1	63	7	0	7
S1C1	68	8	-2	6
F2C1	92	13	0	13
S2C1	87	7	-3	4
C2 Subject	Total units	Total positive group	Total negative group	Total group
F1C2	120 (3 dup)	10	-4	6
S1C2	67	3	-2	1
F2C2	67 (1 dup)	4	-1	3
S2C2	57	3	-1	2

Questionnaire Data and the Douglas Model

A questionnaire with 18 questions designed to determine grid and group was administered to each of the four faculty participating in the study. Nine questions involved determination of grid. A plus was tabulated for an answer that scored high grid. A minus was set for a low grid answer. The results of the tabulation for each faculty subject is provided in *Table 5*.

For each faculty subject, *Table 5* gives total number of grid questions, total positive grid and total negative grid. The total grid value is determined by the computation for total positive grid and total negative grid taken together.

TABLE 5

GRID FROM QUESTIONNAIRE AND KEY IN APPENDIX A

C1 Questionnaire	Total grid questions	Total positive grid	Total negative grid	Total grid
F1C1	9	8	-1	7
F2C1	9	4	-5	-1
C2 Questionnaire	Total grid questions	Total positive grid	Total negative grid	Total grid
F1C2	9	6	-3	3
F2C2	9	-6	3	-3

Nine of 18 questionnaire questions involved determination of group. A plus was tabulated for an answer that scored high group. A minus was set for a low group answer. The result of the tabulation for each faculty subject is provided in *Table 6*.

For each faculty subject, *Table 6* gives total number of group questions, total positive group and total negative group. The total group value is determined by the computation for total positive group and total negative group taken together.

TABLE 6

GROUP FROM QUESTIONNAIRE AND KEY IN APPENDIX A

C1 Questionnaire	Total group questions	Total positive group	Total negative group	Total group
F1C1	9	5	-4	1
F2C1	9	9	3	6
C2 Questionnaire	Total group questions	Total positive group	Total negative group	Total group
F1C2	9	7	-2	5
F2C2	9	5	-4	1

Mentoring Data and the Douglas Model

From a third printed hard copy of the interview transcriptions, each unit was analyzed separately to determine whether a condition of mentoring beyond advising was met. If one was met, a plus was assigned to that unit and the number of the condition or characteristic was noted from the list provided by Mertz given in Appendix IV. If a unit contradicted the condition or characteristic, a minus was assigned to that unit. In this analysis there were no duplicate plus and minus entries. That is, at least one mentoring condition was met or denied for each unit or no mentoring conditions were met for that unit. In several instances, however, more than one condition was met with a particular

unit. In that case the unit received one plus and the conditions met were all noted for that unit. A total number was determined for each subject based upon tabulation of pluses and minuses. The results of the analysis and computations are provided in *Table 7*.

For each subject, *Table 7* gives total units, total positive mentoring units from the units tally and total negative mentoring units from the units tally. The total mentoring value is determined by the computation for total positive mentoring and total negative mentoring taken together. Listed under "Total positive mentoring" are the conditions from the Mertz model that were indicated by the analysis of units for *F1C2* and *S1C2*.

TABLE 7

MENTORING BEYOND ADVISOR-ADVISEE STATUS

C1 Subject	Total units	Total positive mentoring	Total negative mentoring	Total mentoring
F1C1	63	0	-3	-3
S1C1	68	0	-1	-1
F2C1	92	0	-1	-1
S2C1	87	0	-4	-4
C2 Subject	Total units	Total positive mentoring	Total negative mentoring	Total mentoring
F1C2	120	10 Conditions: 1, 2, 3, 4, 5, 6, 8, 9, 11 ,13	0	10
S1C2	67	2 Conditions: 4, 5	0	2
F2C2	67	0	0	0
S2C2	57	0	0	0

Findings

Research Question 1

Research question 1 was answered by examining the results of interview and questionnaire tabulation in *Table 3* through *Table 6* as well as by other supporting evidence and considerations in the study. The grid total for *C1* was + 60. Units in the interview transcriptions that were determined to be high grid units outnumbered low grid units significantly. Further, several units were marked that illustrated a marked predominance of high grid. No units were identified that illustrated a predominance for low grid.

When asked question 2 from the questionnaire in Appendix 1, *F1C1* responded, "I ask a lot of questions. I pick on them to make sure." To the researcher this illustrates the constraint of students based upon expectations. After being asked to clarify whether *F1C1* is engaged with the advisee outside of class, *F1C1* responded, "I keep a professional distance from them in a certain way." To the researcher, this indicated insulation of the individual to others outside his or her social layer.

When asked question 2, *F2C2* responded that he will make mistakes on purpose and said, "If they gloss over a mistake when I'm working on the board, it means they're not really following what I'm doing." *F2C2* went on to say, "It also saves your dignity a little bit too because when you make a mistake accidentally, you can say you did it on purpose." To the researcher, these statements indicate significant role distinctions. Furthermore, *F2C2* noted later that the faculty has been discouraged from wearing jeans

or t-shirts and that the faculty have particular codes of conduct that are emphasized. These indicate rule and role dominance in social interactions.

The questionnaire administered to the faculty tabulated a grid total of 6. The combination of the scores and the predominance high grid in some interview answers indicates a high grid category for the mathematics department at *C1*.

C2 on the other hand totaled –74 on interview units. Some units in interviews with subjects representing *C2* were predominantly low grid. *F1C2* noted, "I want to somehow be able to help students realize how math is helpful to them in their every day lives." *F1C2* went on to say, "I feel sometimes like I'm a cheerleader, you can do it… you encourage." To the researcher this illustrates the negotiation of life choices. One may choose to use or not use mathematics in real life. Autonomy is implied. *F1C2* also stated that when students are put in groups to work "they usually choose who they want to be with." Again, freedom of choice and autonomy in role choices are apparent to the researcher.

Discussing *F1C2*, *S1C2* emphasized that "she treats everybody as an individual and each of them with respect. All of the instructors here do this." *S1C2* went on to say, "They want to see you succeed as an individual." These again indicate freedom of the students in choosing roles and indicate personal autonomy.

F2C2 used several statements to indicate that it is hoped that the students realize that the things learned from her are useful things in the real world for living their lives. Obviously the world-view the faculty has in mind is one in which students make choices that influence their life circumstances.

The questionnaire grid total for *C2* was zero. It is noted however that the professor with the most experience at *C2* tabulated –3 for grid. Also the researcher noted that *C1* expressed an aversion to filling out questionnaires and filled it out in a period of three minutes, with less contemplation than would have been expected. This was also due to a time constraint expressed by the subject on preparing for a class. Based on the above considerations, the grid category for *C2* is determined to be low.

Next considered is the group typing of *C1* and *C2*. From the interview transcriptions, the group total for *C1* was +30. Units in the interview transcriptions that were determined to be high group units well outnumbered low group units. Further, several units were marked that most importantly illustrated a marked predominance of high group. No units were identified that illustrated a predominance for low group.

The term "communal" came up several times in the interviews. From the interview transcriptions, *F1C1* said the faculty is "a communal type of faculty." *S1C1* understood and recited the motto of *C1* as "a community of life." *S1C1* also noted that the motto and other traditions involving *C1* is related to the students during a weekend orientation camp for students, which is presided over by priests but has upper-class students in charge. These responses indicate to the researcher not only the transmission of values and beliefs, but that those values and beliefs center around a communal culture. These indicate high group.

F2C1 made many important notes that speak to high group. *F2C1* said, "It is dark when I get here and dark when I leave." This indicates that the life of *F2C1* is largely absorbed in the activities at *C1*, an indication of high group. *F2C2* also affirmed that community nature of *C1*, saying, "The main thing here is community and collegiality."

S2C1 noted that "monks pray before each class if one of them is in a class and is an instructor." This indicates, to the researcher, a strong shared spiritual component at *C1*, again an indication of high group.

The faculty questionnaire total for *C1* indicates and confirms high group for *C1* with a total of 7. Based upon the questionnaire and interview tabulations along with the predominantly high group statements from the subjects, *C1* is typed as high group.

From the interview transcriptions, the group total for *C2* is +12. Units in the interview transcriptions that were determined to be high group units slightly outnumber low group units. Further, a few statements from the interviews conveyed a predominance of high group with no statements conveying a predominance of low group.

F2C2 notes, when speaking of the math lab that operates for all students who want to attend, that more students are apt to show up there since "they feel like they are in an environment over there where everybody is looking for help and nobody is singled out." It can be noted that the existence of such a lab for all students is predominantly high group since the survival of the group as a whole is embraced. Secondly, this statement indicates the valuing of group relationships as important. It should also be noted that group work is utilized largely in the classrooms of both *F1C2* and *F2C2*, with *F2C2* making the final a group final exam in a calculus course taught by *F2C2*.

The questionnaire tabulation for group provides a total of +5. One more consideration will help in the group category for *C2*. It was noted that *C2* is predominantly low grid. If we examine the conditions of low grid and low group, *C2* is surely excluded. A key aspect of low group and low grid is the ambiguity of relations among individuals. Relationships of individuals are not ambiguous since there are clear

distinctions of title grade and accomplishment at *C2*. Knowledge is not unrestricted in access since one is constrained by enrollment and attendance, another key aspect of low group and low grid. It was noted by both *F1C2* and *F2C2* that points were awarded for attending classes at *C2*.

Based upon the tabulation with interviews and questionnaires, the highlight of statements that support high group, and the reasoning that rules out low grid and low group, *C2* is types as high group.

Combined Grid and Group Findings. Combining the separate analyses for grid and group, the following determination is rendered: *C1* is high grid and high group, and *C2* is low grid and high group.

Research Question 2

The conclusion from the interview data is clear cut. It is likely that mentoring according to the Mertz model was present between *F1C2* and *S1C2*. There are two further qualifications to consider.

First, *F1C2* and *S1C2* essentially agreed on the definition of mentoring. The suggestion is that if mentoring is taking place, the advisor and advisee will have some common shared understanding of what is taking place. Secondly, the qualification for this relationship is that the student was actually employed under the watchful eye of *F1C2*. This employment however, in analysis, came as a consequence of the interaction between *F1C2* and *S1C2*. In addition, much of the interaction between *F1C2* and *S1C2* was apparently voluntary. *S1C2* would call *F1C2* at various times and discuss personal issues. *S1C2* created and collected notes on the practice of teaching that *S1C2* shared with *F1C2*.

There was no evidence of mentoring in the other three relationships. There was, however, plenty of evidence of advising. The subjects were of course chosen based upon the advisor-advisee relationship.

Research question 2 was addressed by conducting an analysis of the conditions beyond advising that account for mentoring using the Mertz model. Each condition was first examined separately using the Douglas model and characteristics of the high grid and high group quadrant. A determination was made whether that condition was supported by the inherent characteristics of the high grid and high group quadrant. If supported, or if not, a reason was elaborated. Similarly a determination was made whether each condition in the Mertz model was supported by characteristics of the low grid and high group quadrant of the Douglas model. A reason was elaborated for or against support. Some conditions were undetermined and left undesignated

Table 8 provides a listing on the left of Mertz model conditions for mentoring. On the right, a brief answer is given regarding whether that condition was supported by the characteristics of high group and high grid. A reason was elaborated excepting where no determination was made. In that case the result support was considered neutral.

TABLE 8

C1 HIGH GRID AND HIGH GROUP

Focus on the future	No. Life support and control of individual behavior limits choices.
Focus on professional advancement	No. The group boundary is constrained and there is low to moderate competition.
Teach, mold sponsor	Yes. Group boundary confines.
Personal-professional relationship	Yes. Personal relationship within the group boundaries.
Associated responsibility for outcome	No. Insulation is moderate. Control of individual behavior.
Direct benefits in addition to personal benefits	No. Resources are distributed equally.
Must share power	No. Specialization of roles, variety of solutions to problems.
High professional risk	No. Insulation is moderate.
High emotional investment	Neutral.
Can mentor few	No. Compartmentalization and specialization allow for expanse.
Must have an affinity for the protégé	No. Constraining group boundary.
Free and voluntary choice	No. Choices and autonomy are restricted.
Opens doors; expands opportunities	No. Boundary constrains.

Table 9 provides a listing on the left of Mertz model conditions for mentoring. On the right, a brief answer is given whether that condition was supported by the characteristics of low grid and high group. A reason was elaborated excepting where no determination was made. In that case the result support was considered neutral.

TABLE 9

C2 LOW GRID AND HIGH GROUP

Focus on the future	Yes. Emphasis on spiritual individual growth.
Focus on professional advancement	Yes. Weak controls for interchange.
Teach, mold sponsor	Yes. Emphasis on spiritual individual growth.
Personal-professional relationship	Yes. Low insulation.
Associated responsibility for outcome	No. Control of individual behavior.
Direct benefits in addition to personal benefits	Yes. Weak control of interchange.
Must share power	Yes. Power to suppress contrary views is weakened. Pressing for rules of transactions if the terms are against an individual
High professional risk	Neutral.
High emotional investment	Neutral.
Can mentor few	Yes. Pressing for rules of transactions if the terms are against an individual.
Must have an affinity for the protégé	No. Little support for individual.
Free and voluntary choice	Yes. Power to suppress contrary views is weakened.
Opens doors; expands opportunities	Yes. Weak controls for interchange.

According to this determination, the Douglas model indicates the potential for mentoring in low grid and high group. It also appears that the potential is diminished in high grid and high group.

Research Question 3

The results of this study conform to the foregoing statements regarding the predictability using the Douglas model.

Researcher's Observations

The sites examined were distinctly different. The respondents seemed eager to help the researcher with the quest of the study. *F1C1* seemed less sure about answers then did *F2C1*, *S1C1* and *S2C2*. Perhaps it was the fact that *F1C1* was relatively new. Perhaps it was because *F1C1* seemed less entrenched in the traditions of *C1*. It seemed also that the subjects at *C1* were indeed thinking of the mentoring relationship and even hopeful that they would be discovered. The researcher aimed to downplay this by suggesting to the subjects that culture in general was being studied as well.

S2C1 was of a faith different from that of *C1*. It was perceived that the student had some difficulty with the circumstances by the researcher. The student felt relatively welcome at *C1*, but mentioned a disparity between expectations and what *S2C1* actually found at *C1*. This incongruence may account for the low group tally recorded for the interview with *S2C1*.

At *C2* the culture was much more diffuse. *S2C2* noted, for example, that she did not know any other of the math majors on campus. *S1C2* also stated that efforts have been made to formalize student math organizations to little avail.

It is also noteworthy that *C1* and *C2* listed ongoing structured mentoring programs in their brochures and websites. These programs, however, were not participated in by the math faculty at either institution. The best way to describe the structured mentoring programs at both *C1* and *C2* is that they involve a common interest of mentor and mentee vs. the characteristics beyond mentoring that the Mertz model affords.

C1 is considered high grid because there is little competition and more cooperation with insulation. There is distance between the instructors and students, between instructors and priests, between administrators and staff. This distance is illustrated by dress, office location, and demeanor. The instructors and students are also insulated from outsiders, with their campus being located in a rural type of area and accessible by a single long drive. Formal prescriptions are imposed through the traditions of the Catholic Church, structured orientation camp, and the taking of math courses early in the student's career.

Narrative Conclusion *C1*

C1 is considered high group because of the value in the collective relationships students have among themselves and related to the Catholic Church influence. Pay is low for the faculty, and volunteer work is ever present. This is indicative of sacrifice and service for the collective good. *C1* has survived over many years of tradition despite the circumstances of low pay and generally low resources. There is strong group allegiance with numerous t-shirts, a coat of arms, and slogans. The defining motto of *C1* is community. Life at *C1* is communal. The beliefs, traditions, goals and customs are indistinguishable from those of the Roman Catholic Church. Resources are shared with most of the students living on campus.

Narrative Conclusion *C2*

C2 is considered low grid since students have limited autonomy. For example, they can all attend computer labs and have assistance outside of class, but those

environments are typically structured. The diversity of the student population and the faculty (there are 59 adjunct instructors with varied backgrounds of education and experience) creates a mildly competitive environment with few social distinctions.

C2 is considered high group since there is a strong corporate mission of serving students with quality instruction and choices that will help them succeed. In addition, the instruction is structured with group study opportunities throughout. An example is the math lab, at which faculty members volunteer for hours to oversee. Many students are unconventional, and some are there because they were not accepted elsewhere. This differentiates the population as insider/outsider. Overall there is a stability at *C2* that is necessary for serving the student population that is its focus.

Table 10 lists considerations for the grid/group quadrant social profiles and provides a contrast for *C1* and *C2*.

TABLE 10

SOCIAL PROFILES: INDIVIDUAL AND GROUP

Bureaucratic	Corporate *C1* High Grid and High Group • Emphasis on achieved role status: More cooperation and little competition. • Insulation with little autonomy: Distance kept by instructors. Required courses for math degree taken early and effort to get more students in math related subjects. • Insider-outsider status: Christian predominance and rules of conduct. • Group survival based on traditions of the Roman Catholic Church and Benedictine Service. • Life support from the group: 90% on financial aid. Residential housing predominates. • Allegiance to group: Strong orientation, many volunteer activities in the name of *C1*. • Low income and spiritual aspect: Low faculty salaries and volunteer work as service, prayer in class and scheduled during the week. Control of individual behavior: Codes of conduct, Christian expectations.
Individualist	Collectivist *C2* High Group and Low Grid • Strict insider-outsider conditions: Based upon class policies and a large population of students who not accepted else where. • Group survival: Opportunities for students in getting assistance, fee waivers, etc. Also managed group work in classes. For faculty, sharing of resources of office space and equipment. Emphasis upon quality of instruction for students and availability of services for students. • Limited individual autonomy in choices of study group partners and attending extra study sessions. For faculty, limited courses geared toward support and stability. • Ambiguity of relationships: *S1C2* was a student and supplemental instructor.

CHAPTER V

SUMMARY, CONCLUSIONS, OVERVIEW AND RECOMMENDATIONS

This chapter includes a summary and discussion of the results of this study. Findings presented in Chapter IV are summarized.

The problem in this study involved the use of the Douglas Model in addressing the mentoring between faculty and students in higher education.

The research questions were the following:

1. What is the grid and group structure of each institution's mathematics setting for math students and math faculty and their interaction?
2. How is Mary Douglas's group/grid model useful in predicting mentoring relationships?
3. If there are differences in predictions and the research data, how can they be explained?

Summary of Findings

The institutions selected for study were purposively chosen based upon their apparent differences. These differences have been and remain apparent to the researcher over the period of many years. The findings of this study are based upon differences illustrated by using Mary Douglas model in typing them according to a grid and group analysis and the subsequent social profile.

The findings of this study for research question 1 are: The grid and group structure for *C1* was high group and high grid. The grid and group structure for *C2* was high group and low grid.

The findings of this study for research question 2 are: The Douglas model indicates possible support for mentoring in the high group and low grid quadrant of the Douglas typology.

The findings of this study for research question 3 are: The prediction conformed to the research results. Using the Mertz model, a pair of subjects in *C2* was determined to have a mentoring relationship, and no other pairs studied exhibited the mentoring relationships.

Conclusions

The conclusions drawn from this study were as follows: The variety of definitions of mentoring creates an array of situations that are called mentoring and for which it is difficult to ascertain whether the mentoring relationship exists independent of name. Where the advisor-advisee relationship is assumed, in higher education it is possible to determine whether other conditions for that account for mentoring are met. Further, the Douglas typology and social profiling of culture provides a vision of how mentoring may be supported or restricted in those specific cultural settings. Specifically, the low grid/high group quadrant of the Douglas typology accounts for 9 of the 13 conditions for mentoring according to Mertz's conditions, leaving 2 neutral. The research comparing the two sites confirms this result.

Overview of Cases

The cultures of *C1* and *C2* were distinct as the research concludes. There were some interesting similarities and differences in the two sites. As an example, students at both institutions were largely financially supported. At *C1* the support evoked identification with the religious community. This identification was reinforced in several ways as this study indicated. At *C2* on the other hand support was state sponsored.

Overall the variable that seemed to most account for the differences between the two sites was a sense of obligation. The students and faculty in the mathematics department at *C1* were more obligated to the institution, its survival, its rules, and traditions. The students and faculty in the mathematics department at *C2* were overall more concerned with outside jobs, families, friends, and other aspects of their personal lives.

Another noteworthy comparison involved reported or self-described mentoring programs at each institution. It was stated that none of the math faculty members at either institution were involved in formal or structured mentoring between faculty and student. Both *C1* and *C2* however, listed in promotional material "mentoring programs" available to students.

Inquiring with officials at *C2*, the mentoring program listed on the web site was described as peer mentoring involved in the supplemental instruction. Supplemental instruction was the instruction outside the classroom that was available in the math lab at *C2*. The employment classification of *S1C2* was that of supplemental instructor. For *S1C2* and other supplemental instructors, there was no mentoring training but it was

assumed that *S1C2* being a student, would engage and assist other students, sharing in a common interest of understanding the material and doing well in math coursework.

In addition, *C2* had an Upward Bound program that served selected high schools in the metropolitan area. Designated high schools in the Upward Bound program were visited by faculty members from *C2*. Officials at *C2* offered no mentor training for the Upward Bound program but did offer faculty some general good practice advice for engaging high school students. It is noteworthy that *F1C2* had a minor involvement with the upward bound program in past years, visiting a few sites. *F1C2* would go to high schools off campus and speak to students about the benefits of college and the opportunity that existed at *C1*. Again this activity was described by an official at *C2* as a possible form of mentoring.

The researcher inquired at *C1* regarding any formal mentoring programs. In particular one was listed in the brochures obtained from *C1*. The lead academic official summarized that the mentoring program alluded to was an idea involving faculty and students that was promoted but one which never transpired. No students and no faculty were ever engaged in mentoring, none were trained and the idea was never implemented.

At both institutions, these self-described mentoring programs promoted were not mentoring between faculty and student. It should be pointed out however that the two subjects *F1C2* and *S1C2* where a mentoring relationship was present were engaged in activities that were espoused by their institutions as mentoring programs.

Research in mentoring suggests that commonalties shared by mentor and mentee enhance or are obstacles to the effectiveness of mentoring and the mentor/mentee relationship. Smink (1999) lists for example, the importance of generation difference as

important to the relationship. It is noted that the ages of those where a mentoring relationship was present are closer than with any of the other subject pairs. In addition, it was apparent that *F1C2* and *S1C2* shared many common interests in education as well as in life in general. Their personal relationships were important.

Benefits of Using the Models

It is noted overall that culture plays a big part in enhancing or hindering mentoring. Mentoring involves personal relationships. The Mertz model and the Douglas model complemented each other in that they both were capable of handling individual relationships. Mentoring also involves the cultural context in which it takes place. The Mertz model and the Douglas model contrasted with each other in a fruitful way. The Douglas model was broad while the Mertz was specific and criterion based. The Douglas model was useful in this research as it provided a way to view. screen and identify the salient features of culture at the two sites. The Mertz model was useful in allowing for specific determination of whether definitional criteria for mentoring were met and allowing for clear judgment.

Further Study

With the Douglas model providing the majority of conditions for mentoring in the institutions typed high group and low grid, the suggestion arises of whether one might ameliorate the meeting the conditions that are left unmet in a particular cultural setting through intervention. Further, might the Douglas model also be used in other educational settings to characterize conditions for other educational programs that are deemed

beneficial? After the characterization and accounting for the salient conditions for an educational program, might it be possible to address what is lacking in the particular culture that allows or fosters the program?

Research into these areas may do two things. It might promote a viable definition of mentoring that is effective in its use. It might also provide a general strategy for using the Douglas model in other educational settings to provide positive outcomes.

Recommendations for Research

It is recommended that:

1. Another study should be done with different sites to examine their grid/group structure of the mathematics departments and to use an appropriate model of mentoring to determine if mentoring is present.
2. An appropriate model for mentoring of undergraduate students should be created which accounts for both career orientation and continuing to graduate or professional school. It seems appropriate that a proxy for career advancement might be educational advancement.
3. Other studies should be done with different sites to examine their grid/group structure of other academic departments and to use an appropriate model of mentoring to determine if mentoring is present.

Recommendations for Practice

It is recommended that:

1. Institutions do not use the word "mentoring" to encompass peers interacting, the simple sharing or common interest, encouragement, advisement, coaching, etc. In higher education, mentoring requires extensive involvement, specific intent focussing on career, high commitment, and comprehensiveness of influence.
2. Institutions determine through examination of their culture whether mentoring is appropriate for their institution. The Douglas typology can be useful here.
3. Institutions consider the conditions beyond advising as in the Mertz model to account for mentoring.
4. Institutions consider the characteristics of the mentor and account for effectiveness of mentoring and potential obstacles based upon the conditions such as social distance/closeness, inclinations and predisposition of the mentor, etc.

REFERENCES

Battin, P. (1997). Diversity and leadership: mentoring builds leaders of the future. *Cause/effect, 20,* (1), 15-17.

Boettger, C. L. (1997). The application of grid and group theory in the study of social constraints in one site-based managed school district. Doctoral Dissertation, Oklahoma State University.

Boyd, P. J. (1997). Mentoring by college faculty: perception by students in evaluation of their satisfactions. Doctoral Dissertation, University of Southern Mississippi.

Cohen, N. H. (1995). The principles of adult mentoring scale. In Galbraith, M. & Cohen, N. (Eds.) (1995). *Mentoring: new strategies and challenges. New directions for adult and continuing education* (No. 66*)*. San Francisco: Jossey-Bass.

Clawson, J. (1980) Mentoring and managerial careers. In C. B. Derr, (Ed.), *Work, Family, and the Career* (pp. 144-165). New York, NY: Praeger.

Coursert, D. K. (1999) The effects of mentoring intervention program on retention of students in a community college. Doctoral Dissertation, Purdue University.

Czerwinski, R. & Haverals, J. (personal communication, October 28, 2001)

Davis, B. J. (1989). The mentor-mentee relationship between doctoral advisors and advisees at an historically black university. Doctoral Dissertation, Texas Southern University.

Denzin, N. K. (1978). The research act: a theoretical introduction to sociological methods. New York, NY: McGraw-Hill.

Diel, S. L. (1998). Successful rural schools using the Mary Douglas grid and group typology. Doctoral Dissertation, Oklahoma State University.

Douglas, M. (1982). In the active voice. London: Routledge & Kegan Paul.

Earlandson, D. A., Harris, E. L., Skipper, B. L. & Allen, S. D. (1993). Doing naturalistic inquiry: a guide to methods. Newbury Park, CA: Sage.

Galbraith, M. & Cohen, N. (Eds.) (1995). Mentoring: new strategies and challenges. *New Directions for Adult and Continuing Education.* (No. 66). San Francisco, CA: Jossey-Bass.

Golian, L.M. & Galbraith, M. W. (1996). Creating effective mentoring programs for professional library development. *Advances in Library Administration and Organization* (Vol. 14, pp. 18-24).

Gunn, E. (1995, August). Mentoring: The democratic version. In *Training, 32,* (8), pp. 64-67.

Harris, E. (1994). Toward a grid and group interpretation of school culture. *Journal of School Leadership, 5,* pp. 617-647.

Harris, E. (1995, August). Applying Mary Douglas's grid and group typology to four schools. *Educational Administration Quarterly.*

Haney, A. (1997). The role of mentorship in the workplace. In M. C. Taylor (Ed.), *Workplace Education.* Toronto, Ontario: Culture Concepts.

Head, F. A., Reiman, A. J. & Thies-Springhall, L. (1992). The reality of mentoring: complexity in its process and function. In Bey, M. & Holmes, C. T. (Eds.), *Mentoring Contemporary Principles and Issues.* Reston, VA: Association of Teacher Educators.

Hess, A. K. & Sauser, W. I. (2001). Students and faculty: the growth of relationships. In Walfish, S. & Hess, A. K. (Eds.), *Succeeding in Graduate School: The Career Guide for Psychology Students.* Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Higgins, L. K. (1998). The impact of a mentoring program on the self-esteem of college-age women. Doctoral Dissertation, University of North Texas.

Holstein, J. A. & Gubrium, J. F. (1994), Phenomenology, ethno methodology, and interpretive practice. In Denzin, Norman K. & Lincoln, Yvonna S. (Eds.), *Handbook of qualitative research* (pp. 263-272). Thousand Oaks, CA: Sage Publications, Inc.

Howard, J. & Grosset, J. (1992, Summer). Student Responses to a Community College Faculty Mentoring Program. *Community College Review, 20,* (1), pp. 48-55.

Janesick, V. J. (1994). The dance of qualitative research design: Metaphor, methodolatry, and meaning. In Denzin, Norman K. & Lincoln, Yvonna S. (Eds.), *Handbook of Qualitative Research* (pp. 209-219). Thousand Oaks, CA: Sage Publications, Inc.

Kartje, Jean V. (1996). O mentor! my mentor!, *Peabody Journal of Education, 5,* 114-125.

Lincoln, Y. S. and Guba, E. G. (1985). Naturalistic inquiry. Beverly Hills, CA: Sage.

Lingenfelter, S. (1998). Transforming culture: A challenge for Christian missions. Grand Rapids, MI: Baker Books.

Maestas, R. T. (2000). Out-of-class interactions with faculty and selected educational outcomes among Hispanic and Black undergraduates. Doctoral Dissertation, University of Michigan.

Mehlman, E. & Glickauf-Hughes, C. (1994). Understanding developmental needs of college students in mentoring relationships with professors. *Journal of College Student Psychotherapy, 8,* (4), 39.

Mertz, Norma T. (2001, April). *Unraveling the definition threads: mentoring and academe.* Paper presented at the annual meeting of the American Educational Research Association, Seattle, WA.

Moseley, P. L. (1999). The relationship of personality factors and academic preparedness with participation in an undergraduate mentoring program. Doctoral Dissertation, Northern Arizona University.

Nelson, R. (1998). The effect of SLS1122 and faculty mentors on student performance (ED 37188)

Odell, S. J. (1992). Evaluating mentoring programs. In Bey, M. & Holmes, C. T. (Eds.), *Mentoring Contemporary Principles and Issues*. Reston, VA: Association of Teacher Educators.

Orr, M. T. (1987). Keeping students in school: A guide to effective dropout prevention programs and services. San Francisco, CA: Jossey-Bass.

Patano, J. (1994). Comprehensive minority seminar programs at Santa Fe Community College (ED 371797) .

Patton, D. M. (1999). Power: if you weren't born with it, acquire it! a study identifying the types of power acquired by mentees from their mentors. Doctoral Dissertation, University of Laverne.

Purvis, J. H. (1998). Analysis of teachers' rewards using Douglas's grid and group. Doctoral Dissertation, Oklahoma State University.

Reiman, A. J., & Edelfelt, R. (1990). School-based mentoring programs; Untangling the tensions between theory and research. (Research Report No. 90-7). Raleigh, NC: Department of Curriculum and Instruction, North Carolina State University.

Sanders, S. E. (1994). Mathematics in Mentoring. In Jarorski, B. & Watson, A. (Eds.), *Mentoring in Mathematics Teaching* (pp. 29-51). Washington, D.C.: The Falmer Press.

Shulz, S. F. (1995). The benefits of mentoring. In Galbraith, M. & Cohen, N. (Eds.) (1995). *Mentoring: New Strategies and Challenges. New Directions for Adult and Continuing Education (No. 66).* San Francisco, CA: Jossey-Bass.

Smink, J. (1999). *A training guide for mentors*. (Report No. NCRTL-RR-##-#). Clemson, SC: National Dropout Prevention Center. (ERIC Document Reproduction Service No. ED 346082)

Stake, Robert E. (1994). Case Studies. In Denzin, Norman K. & Lincoln, Yvonna S. (Eds.), *Handbook of Qualitative Research* (pp. 236-247). Thousand Oaks, CA: Sage Publications, Inc.

Terrell, M. C. & Hassell, R. K. (1994). Mentoring undergraduate minority students: an overview, survey, and model program. In *Mentoring Revisited: Making an Impact on Individuals and Institutions. New Directions for Adult and Continuing Education (No. 57).* San Francisco, CA: Jossey-Bass.

Wilkins, B. M. (2000). A grounded theory study of personal coaching. Doctoral Dissertation, University of Montana.

Wunsch, M. A. Developing mentoring programs. In Wunch, M. A. (Ed.) (1994). *Mentoring revisited: making an impact on individuals and institutions. New directions for adult and continuing education (No. 57).* San Francisco, CA: Jossey-Bass.

Yeager, L. M. (2000). Mentoring: perceived benefits and challenges for mentors in a university setting. Doctoral Dissertation, Spalding University.

Yin, R. K. (1994). *Case study research: design and methods.* Thousand Oaks, London, & New Delhi: Sage.

Zachary, L. J. (2000). The mentor's guide. San Francisco, CA: Jossey-Bass

APPENDIXES

APPENDIX A

GRID/GROUP TYPOLOGY QUESTIONNAIRE AND KEY

GRID/GROUP TYPOLOGY QUESTIONNAIRE

For the Mathematics Department Faculty

PRELIMINARY INFORMATION

Position (check one):

○ Full Professor ○ Associate Professor ○ Assistant Professor ○ Instructor ○ Other (Please Explain:) _____

INSTRUCTIONS

Below are 18 pairs of statements. For each pair mark the statement that BEST represents your work environment in the mathematics department. Please remember to keep in mind the mathematics department as you answer each question.

○ Fiscal resources are obtained through individual competition or negotiation	○ Fiscal resources are allotted to individuals by the administration (i.e., either Department Head(s), Associate Dean(s), Dean, or other College Administrator).
○ Work and labor activities are authority directed.	○ Work and labor activities are self-directed.
○ Instructor rank and roles are ascribed by administration (i.e., either Department Head(s), Associate Dean(s), Dean, or other College Administrator).	○ Instructor rank and roles are achieved by individual productivity.
○ Authority structures are decentralized.	○ Authority structures are centralized.
○ Communication channels are formal.	○ Communication channels are informal.
○ Financial resources are obtained through individual competition or negotiation.	○ Financial resources are allotted to the faculty by the administration (i.e., either Department Head(s), Associate Dean(s), Dean, or other College Administrator).
○ Hiring and placement decisions are decentralized; made by the instructors and/or other non-administrative employees.	○ Hiring and placement decisions are centralized; made by the administration.
○ Curricular decisions are individually negotiated.	○ Curricular decisions are institutionally prescribed by the administration.
○ Institutional rewards motivate instructors.	○ Self-defined interests motivate instructors.

○ Instructors individually control fiscal resources.	○ The math department corporately controls fiscal resources.
○ Work and labor activities are initiated and planned collaboratively by the collective group of the math department.	○ Work and labor activities are initiated and planned by individual instructors.
○ Authority is ambiguous and fragmented.	○ Authority is corporate, with clear accountability to members.
○ Communication flows primarily through individual, informal networks.	○ Communication flows through corporately regulated/maintained processes.
○ Financial resources are corporately regulated/maintained by the math department.	○ Financial resources are individually regulated/maintained by instructors.
○ Hiring and placement decisions are corporately regulated and made by the math department.	○ Hiring and placement decisions are individually regulated and made by instructors and/or non-administrative staff.
○ Social activities and work are kept separate activities.	○ Social activities and work are commingled.
○ Productivity is evaluated according to individual goals and priorities.	○ Productivity is evaluated according to group goals and priorities of the math department.
○ Mentoring practices that occur either formally or informally are for the betterment and success of the individual faculty member in the long run.	○ Mentoring practices that occur either formally or informally are for the betterment and success of math department in the long run.

KEY

GRID/GROUP TYPOLOGY QUESTIONNAIRE
For the Mathematics Faculty

○ Fiscal resources are obtained through individual competition or negotiation **LOW GRID - 1**	○ Fiscal resources are allotted to individuals by the administration (i.e., either Department Heads, Associate Dean(s), Dean, or other College Administrator). **HIGH GRID +1**
○ Work and labor activities are authority directed. **HIGH GRID +1**	○ Work and labor activities are self-directed. **LOW GRID -1**
○ Instructor rank and roles are ascribed by administration (i.e., either Department Heads, Associate Dean(s), Dean or other College Administrator) **HIGH GRID +1**	○ Instructor rank and roles are achieved by individual productivity. **LOW GRID -1**
○ Authority structures are decentralized. **LOW GRID -1**	○ Authority structures are centralized. **HIGH GRID +1**
○ Communication channels are formal. **HIGH GRID +1**	○ Communication channels are informal. **LOW GRID -1**
○ Financial resources are obtained through individual competition or negotiation. **LOW GRID –1**	○ Financial resources are allotted to the faculty by the administration (i.e., either Department Head(s), Associate Dean(s), Dean, or other College Administrator). **HIGH GRID +1**
○ Hiring and placement decisions are decentralized; made by the instructors and/or other non-administrative employees. **LOW GRID -1**	○ Hiring and placement decisions are centralized; made by administration. **HIGH GRID +1**
○ Curricular decisions are individually negotiated. **LOW GRID -1**	○ Curricular decisions are institutionally prescribed by the administration. **HIGH GRID +1**

○ Institutional rewards motivate instructors. **HIGH GRID +1**	○ Self-defined interests motivate instructors. **LOW GRID –1**
○ Instructors individually control fiscal resources. **LOW GROUP –1**	○ The math department corporately controls fiscal resources. **HIGH GROUP +1**
○ Work and labor activities are initiated and planned collaboratively by the collective group of math department. **HIGH GROUP +1**	○ Work and labor activities are initiated and planned by individual instructors. **LOW GROUP –1**
○ Authority is ambiguous and fragmented. **LOW GROUP -1**	○ Authority is corporate, with clear accountability to members. **HIGH GROUP +1**
○ Communication flows primarily through individual, informal networks. **LOW GROUP –1**	○ Communication flows through corporately regulated/maintained processes. **HIGH GROUP +1**
○ Financial resources are corporately regulated/maintained by the math department. **HIGH GROUP +1**	○ Financial resources are individually regulated/maintained by instructors **LOW GROUP –1**
○ Hiring and placement decisions are corporately regulated and made by the math department. **HIGH GROUP +1**	○ Hiring and placement decisions are individually regulated and made by instructors and/or non-administrative staff. **LOW GROUP –1**
○ Social activities and work are kept separate activities. **LOW GROUP -1**	○ Social activities and work are commingled. **HIGH GROUP +1**
○ Productivity is evaluated according to individual goals and priorities. **LOW GROUP -1**	○ Productivity is evaluated according to group goals and priorities of math department. **HIGH GROUP +1**

○ Mentoring practices are for the betterment and success of the individual students in the long run.

LOW GROUP -1

○ Mentoring practices are for the betterment and success of the math department in the long run.

HIGH GROUP +1

APPENDIX B

INTERVIEW QUESTIONS ASKED OF FACULTY SUBJECTS

Subjects were told that the researcher is interested in the mentoring relationship and that the advisee would also be interviewed.

1. Explain your philosophy of teaching
2. How do you help your students learn inside the classroom?
3. How do you help your students learn outside the classroom?
4. Define mentoring.

APPENDIX C

INTERVIEW QUESTIONS ASKED OF STUDENT SUBJECTS

Subjects were told that the researcher is interested in the mentoring relationship and that the advisor would also be interviewed.

1. Explain the teaching and learning environment for your math classes.
2. How do the instructors help you learn inside the classroom? How do the instructors help you learn outside the classroom?
3. Define mentoring.

APPENDIX D

MERTZ MENTOR CHARACTERISTICS

Advisor	Mentor
1) Focus on the present	1) Focus on the future
2) Focus on professional development	2) Focus on professional advancement
3) Help, guide, advise	3) Teach, mold, sponsor
4) Professional Relationship	4) Personal-professional relationship
5) Limited responsibility for outcome	5) Associated responsibility for outcome
6) Limited professional benefits except for the satisfaction of doing a good job	6) Direct professional benefits in addition to personal benefits
7) No necessity to share power	7) Must share power.
8) Low professional risk	8) High professional risk
9) Moderate emotional investment	9) High emotional investment
10) Can advise many	10) Can mentor few
11) Do not have to like the advisee	11) Must have an affinity for the protégé
12) Semi-voluntary activity (hard to refuse, sometimes assigned)	12) Free and voluntary choice
	13) Opens doors; expands opportunities

APPENDIX E

CONSENT FORM

Consent Form

General Information:

You have been selected to participate in an Oklahoma State University doctoral student, Richard S. Neal's research project. The purpose of the research is to determine if social environment will predict mentoring relationships between math faculty and students.

The doctoral student will use the information collected in the survey and/or interview questions as sources of data. The survey instrument should take no longer than thirty minutes to complete and the interview questions will last no longer than one hour. All survey and/or interview questions will be directly relevant to the research project. All selected faculty will be asked the same initial questions. All selected students will be asked the same initial questions. The doctoral student will tabulate and analyse all data. All information received will be treated as confidential materials and will be kept secure by the doctoral student.

A completed consent form must be secured from both the faculty and students, with a copy provided to the lead administrator before the survey and/or interview questions can be administered. All data will be destroyed at the end of the research project or no later than May 31, 2002.

Subject Understanding:

I understand that participation in the research project is voluntary; there is no penalty for refusal to participate; and I am free to withdraw my consent and participation in this research project at any time without penalty by notifying the doctoral student.

I understand that the survey and/or interview questions will be conducted according to commonly accepted research procedures and that information taken from the instruments will be recorded in such a manner that subjects cannot be identified directly or through identifiers linked to the superintendent.

I understand that the instruments will **not** cover topics that could reasonably place the faculty or students at risk of criminal or civil liability or be damaging to the financial standing or employability or deal with sensitive aspects of the subjects own behavior such as illegal conduct, drug use, or sexual behavior.

I may contact doctoral student, Richard S. Neal, at 800-229-1725 in case of any concerns. I may also contact IRB Executive Secretary Sharon Bacher; University Research Services; 203 Whitehurst; Oklahoma State University; Stillwater, OK 74078; 405.744.5700.

I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Subject_____ **Date** ___**Time**____

I certify that I have personally explained all elements of this form to the faculty member/student before requesting the faculty member/student to sign it.

Doctoral Student _____ **Date**_____ **Time**_____.

APPENDIX F

INSTITUTIONAL REVIEW BOARD

Oklahoma State University
Institutional Review Board

Protocol Expires: 10/9/02

Date: Wednesday, October 10, 2001 IRB Application No ED0228

Proposal Title: DISSERTATION: MATHEMATICS FACULTY AND STUDENTS: MENTORING AND THE DOUGLAS MODEL

Principal Investigator(s):

Richard Neal
204 Willard
Stillwater, OK 74078

Edward Harris
325 Willard
Stillwater, OK 74078

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

Dear PI :

Your IRB application referenced above has been approved for one calendar year. Please make note of the expiration date indicated above. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved projects are subject to monitoring by the IRB. If you have questions about the IRB procedures or need any assistance from the Board, please contact Sharon Bacher, the Executive Secretary to the IRB, in 203 Whitehurst (phone: 405-744-5700, sbacher@okstate.edu).

Sincerely,

Carol Olson, Chair
Institutional Review Board

VITA

Richard S. Neal

Candidate for the Degree of

Doctor of Education

Thesis: MATHEMATICS FACULTY AND STUDENTS: MENTORING AND THE DOUGLAS MODEL

Major Field: Higher Education

Biographical:

Personal Data: Born in Tulsa, Oklahoma, April 1, 1949, the son of Mr. and Mrs. John W. Neal.

Education: Graduated from Charles Page High School, Sand Springs, Oklahoma, May, 1967; Received the Bachelor of Science degree in Mathematics from the University of Oklahoma in 1985; received the Master of Education degree in Educational Technology from the University of Oklahoma in 1988; received the Master of Arts degree in Philosophy from the University of Oklahoma in 1992; received the Master of Arts degree in English from the University of Central Oklahoma in 1997; received the Master of Science degree in Psychology from Cameron University in 1997, estimate completing the requirements for the Doctor of Education degree in Higher Education from Oklahoma State University, Stillwater, Oklahoma, in May 2002.

Professional Experience: President, American Society for the Communication of Mathematics, 1995-present; Lecturer in Mathematics, University of Oklahoma, 1987-present; Educational Services Manager, The Daily Oklahoman, 1997-present.