MEANING-RELATED INDICATORS OF AFFECT IN COMPUTER-MEDIATED INSTRUCTION CURRICULUMS

by

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DEDICATION

This work is dedicated to:

Adrianne Proctor

my wife, who has seen, explored, discovered, enjoyed, forgiven, created, and loved much with me in our life together;

Ruth Hartsfield

my mother, who (among the gifts she gave and examples she set) instilled in me the love of music which has been an affective balm to me all my life; and

Grover B. Proctor, Sr.

my father, whose diligence, selflessness, quiet strength, courage, and gentleness of spirit set an example that continues to inspire and lead me. I miss you.

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CHAPTER ONE
INTRODUCTION

“Teaching is by its nature the process of changing behavior.”
-Leonard Kaplan

The ostensibly behavioristic truism quoted above (Kaplan, 1986, p.17) came from one of this era's foremost experts on and apologists for the integration of affective components into cognitive-oriented curriculum. This apparent paradox graphically demonstrates the interrelatedness of such seemingly distant and polarized concepts as cognition, affect, and behaviorism. In fact, that interrelatedness has been known and touted by scholars for years. Piaget said, "There are not affective behaviors and cognitive behaviors: they are always both at the same time" (1954, p.67). Speaking of the affective and cognitive domains of educational and psychological study, Kaplan maintained that "in some respects, it is almost impossible to distinguish between the two" (1986, p.10). Sometimes, however, the very scientific act of trying to study these primary and key concepts can drive researchers further from understanding how they really work.

The process of logical positivistic research (and therefore much of the scholarly research-based literature on which curriculum and education theory has been formulated in recent decades) has as one of its hallmarks the reduction of phenomena down to their smallest components (concepts), and then holding all other concepts static, while one is manipulated to discover its effect(s) on the organism under study. Borrowed from the physical sciences, this process has myriad advantages in discovering, under scientifically controlled circumstances, truths about often minute aspects of a whole which, the researcher hopes, will then be generalizable to a larger context.

But that very strength is also often a weakness when social science researchers try to understand the complexity of a system such as that described above by Kaplan and Piaget. If one is truly to attempt to understand the educational process as it currently exists, especially if one's goal is ultimately to maximize the internal components and concepts (e.g., behavioristic models, affective components, increased and sustained cognitive learning), then other approaches and other metaphorical viewing devices may need to be sought--methods which allow for comprehending and measuring the cross-currents of interconnected concepts which form the learning/instructional process.

Another barrier that has sometimes prevented a full study of the issues related to the affective component of curriculum and of the educational process in general is the belief by some that the affective domain is at worst a chimera or at best a concept the relevance of which is suspect or nil. Strict behaviorists, in particular, tend to find no need for this paradigm to explain processes. Skinner (1953) flatly asserted that such concepts are examples of fictional causes to which behaviors are commonly attributed. Others have shied away from attempting to bring the affective component into a theoretical model or into practical applications because they find it “difficult to conceptualize and to evaluate” (Martin & Briggs, 1986, p. 12). The humanistic quality of the affective domain has led some who hold varying ideological (e.g., political, religious, conceptual) beliefs to shun the idea of incorporating affective components into curriculum and to deny its efficacy therein (Pettapiece, 1992). These objections noted and to the contrary, the growing scholarly literature on the affective domain, dating back decades, which has found it to be a viable, constructive, cogent concept, as well as a useful tool for the planning of curriculum and the delivery of instruction, (e.g., Combs, 1962; Kaplan, 1978; Kaplan, 1986; Knicker, 1977; Krathwohl, et al., 1964; Martin & Briggs, 1986) seems to overwhelmingly decide the issue in favor of affect being a valid and vital area of study.

Thus, as the quantity of studies into and the scholarly theoretical underpinning concerning the affective domain are increasing inside the educational realm, it is clear that the face of education is changing rapidly and fundamentally. As education moves into new and to-date often uncharted waters of computer-mediated instruction (CMI), it becomes all the more important to try to understand the interactions and efficacy of such concepts as the affective and cognitive domains and how they relate to the new instructional paradigms, in order to ascertain the effectiveness and therefore advisability of this new medium of instructional delivery.

Just as computer-mediated instruction is in its infancy, so of course is research designed to tell educators and curricular experts how it works and when it works and how it affects students being subjected to it. In particular, there is a real paucity of research that attempts to try to understand the affective component of this cognitive tool of the computer. Those studies which do exist center almost exclusively in two general areas: computer anxiety (to what degree does a student's fear of the computer influence her or his learning?) and gender studies (are the stereotypes concerning women's avoidance of computers valid, and what is the basis for these beliefs?). There have been virtually no studies done which have attempted to discover the extent and impact of an affective component in existing computer-mediated instruction, and even less with the goal of trying to find ways to maximize any positive influence that affect may have in that process.

While it may be true that this type of research has not been done because the other issues (e.g., anxiety and gender) are more pressing and immediate, it may also be that finding ways to delve into the interconnectedness of the various components mentioned above has eluded researchers. With characteristic confidence, McCroskey has stated, "The best way to find out something about someone is to ask her or him" (1984, p. 85). This seems particularly prescient advice in an attempt to find out about the affective component of anything, since affect is inextricably connected to the perception of the individual. Knowing what and how to ask is, however, often not easily definable.

Examining a student's behaviors is frequently not enough to tell educators all of the factors that went into the formulation of that behavior, nor the motivations behind it. Nevertheless, as Osgood stated,

> Most social scientists would agree--talking freely on common-sense grounds--that how a person behaves in a situation depends upon what that situation means or signifies to him. And most would also agree that one of the most important factors in social activity is meaning and change in meaning--whether it be termed "attitude," or "value," or something else again. (Osgood, et al., 1957, p.1)

Since both "attitudes" and "values" are integral parts of any definition of affect (Kaplan, 1986), there is perhaps emerging here a fundamental truth: that a way of understanding an affective component of anything (be it social interaction or, in this case, computer-mediated instruction) is to attempt to derive an understanding of people's meanings. One key way that this has proven to be able to be accomplished is the use of a fifty-year-old measuring technique called the Semantic Differential, which allows attitudes and belief structures to be communicated through sampling the meaning-centered “semantic space” inside which those attitudes and beliefs are formulated and characterized (Osgood, et al, 1957; Snider & Osgood, 1969).

Therefore, it seems both clear and reasonable, based on all of the above, that a study which examines and measures meaning-derived attitudes related to the practice of computer-mediated instruction (e.g., using the Semantic Differential) has the potential not only to deliver an innovative measure of the affective component inside the learning environment, but also to allow a characterization of the “strength” or “vector” of students’ perception of the affective component through comparison with other measured attitudes toward related concepts. Using the Semantic Differential (see Chapter Three) provides a method for understanding attitude through a non-reductionist, not-solely-cognitive, flexible, and reliable process. To use this means to explore and map computer-mediated instruction (a new and virgin territory, in many ways) in respect to the cross-currents of affect and meaning sets news standards and yet follows in a long and scholarly tradition of understanding the affective paradigm inside the educational environment.

Statement of the Problem

The understanding of affective components inside and throughout computer-mediated instruction has begun with studies into computer anxiety and gender-related Issues. However, to date there have been no studies which have attempted to use the Semantic Differential (or any other measuring device) to try to understand the students' meaning-derived attitudes towards computer-mediated instruction experiences. In order to isolate the factor of affect (and, for the sake of comparison, other closely related but non-affect concepts), students’ meaning-derived attitudes towards the following overall concepts can be examined:

- computer-mediated instruction (CMI)
- activities in which a student would normally engage which contain a high affective component
- traditional (i.e., non-computer) classroom learning activities
- non-classroom uses of computers

In an effort to see if these meaning-derived attitudes can inform, support, or contradict existing educational studies centered around computer anxiety and gender-related issues, this study will include ways to find links to those Concepts. The research questions to be studied may be written thus:

- How do students' meaning-derived attitudes toward computer-mediated instruction relate to their meaning-derived attitudes towards the other three Issues: affective activities, traditional (non-computer) classroom learning activities, and non-classroom uses of computers?
- Does gender difference affect meaning-derived attitudes towards any of the four Issues?
- Does the issue of computer-mediated instruction differ from the other eleven Concepts in relation to the scale of anxious-confident?
- Do faculty's meaning-derived attitudes differ from those of their students in any of the four Issues?

These questions are explored and hypotheses proffered in Chapter Three.

Definition of Terms

In this study, there are two main terms that need definition: the affective domain and computer-mediated instruction (or sometimes computer-mediated learning).

Affect: the presence of certain activities and interchanges, such as those cataloged in taxonomies of Krathwohl et al. (1964) and Kaplan (1986), “which emphasize a feeling, an emotion, a value, or a degree of acceptance or rejection” of the cognitive material (Kaplan, p. 29).

Computer-Mediated Instruction/Learning: instruction (which is usually curriculum-based) that is presented to the student channeled or processed through the medium of computer software. The alternate terms “computer-mediated learning” (CML) and “computer-mediated instruction” (CMI) are used interchangeably, depending on whether the perspective is that of the student or the curriculum creator. This study uses the phrase “computer-mediated” for the same reason and toward the same definitional end as the field of study known as “computer-mediated communication,” which is to say that it conceptualizes the computer in terms more similar to a conduit or catalyst for the action (communication) as opposed to being the root source of it (Jones, 1995). For that reason, other terms which have been used for CMI/CML such as “computer-based instruction” or “computer-assisted instruction” are here rejected because current technological trends are such that instruction can merely “funnel through” a computer (the way messages channel through a telephone), and therefore does not have to be “based” on or in or “assisted” (which connotes augmentation) by that particular piece of hardware.

A further exploration of the scholarly breadth and research-based depth these terms is made in Chapter Two.

Assumptions

The effectiveness of this study hinges on several basic assumptions, all of them anchored to the fact that the instruction used in the study is based on clearly, formally, and correctly written and validated curriculum, and that the computer-mediated instructional portion of the curriculum (whether laboratory or ancillary usages) was both appropriate and typical to the subject matter of the course. It is further assumed that the computer-mediated instruction portion of the courses in which the study was undertaken was appropriate for the age level of those students. And finally, it is assumed that the shared pool of experiences (affective and academic) among the group of participants is wide enough to show a commonality of meaning-derived attitudes, even when those attitudes may change from individual to individual.

Significance of the Study

Not only will this study contribute to further knowledge about the confluence of traditional and computer-mediated instruction, thereby giving one more piece of information on how they differ or are similar in students' perceptions of them as instruments for imparting cognitive material, but also it will serve to show if and how the elements defined as part of the affective domain are perceived by students in the computer-mediated instruction they are already exposed to. Also, until recently, the amount of research conducted to test the interplay of the affective domain within the cognitive goals of computer-mediated (or any other type of) instruction has been relatively small. “Despite the popularity of classroom-based affective education programs, research on the effectiveness of such programs has been sparse and poorly disseminated” (Sterin, 1988, p. 80). The current study will be significant first of all for its attempt to find whether students perceive an affective component inside the computer-mediated instruction they are currently receiving. In addition, it will examine those findings in light of those areas of affect in computer use in which study has previously been done (e.g., anxiety, gender). Regardless of the outcome, when taken in tandem with previous findings about the efficacy of CMI and the role of affect in computer use, this study will provide another link in the practice of and theoretical understanding about education. Finally, it will serve a heuristic purpose in pointing to future new and different directions for study.

Limitations of the Study

This study is limited to the specific time frame in which it is conducted, meaning one specific semester within one given school year. In addition, its results will be limited in applicability to the racially and ethnically homogeneous suburban populations, inside a midwestern state in the United States, represented by the university inside which the study is undertaken. Therefore, its applicability and generalizability to other, larger, different, or more diverse populations will not be demonstrated here.

Organization of the Study

Chapter One contains the introduction, statement of the problem, research questions, definitions of key terms, assumptions, significance of the study, limitations of the study, and this organization of the study.

Chapter Two presents and discusses the relevant literature related to the affective domain, studies of the affective domain in computer use, computer-mediated instruction, and the relation between affective behavior on CMI.

Chapter Three details the design and methodology of the study.

Chapter Four presents the findings of the study, including statistical analyses of the obtained data.

Chapter Five comprises a summary of the implications of the study and a discussion of recommendations for further research.

CHAPTER TWO
REVIEW OF THE LITERATURE

This study builds on the theoretical and research history of affective components inside the computer-mediated learning process. Specifically, it will examine a confluence of the following concepts: affective activities outside of the classroom; non-classroom uses of computers; computer-mediated instruction; and traditional (non-computer) instructional experiences. These issues boil down to the concepts of the affective domain in general; affective issues related to computer use, both inside and outside the classroom; and computer-mediated instruction (as an entity unto itself and as compared to traditional, non-computer instruction).

This chapter begins with a brief overview of, scholarly definition of, and research into the affective domain as it relates to curriculum design and classroom teaching. Since to date just about the only research done specifically investigating the confluence of the affective domain and computer-mediated instruction centers on the issues of computer anxiety and gender-related issues, the next two sections summarize this research. Finally, there is a section on computer-mediated instruction, centered on definition, its effectiveness, and what little the literature reveals about its relationship to affect.

The Affective Domain

Definition of Affect

As alluded to in Chapter One, there are those scholars, educators, and ideologues who either deny the existence of a constructive concept called "affect" or who suggest that its very amorphous nature makes it incapable of exact definition. Kaplan (1986) touched on the difficulty of defining affect when stating,

> Definitions have been developed for the cognitive as well as psychomotor domains. Schools speak to this quite well.... What cannot be classified as cognitive or psychomotor must therefore be affect. It is out of the ambiguity that some of us have had to work and defend our right to exist. In some circles affect has received a bad reputation. It has meant anything to everything. Handholding, body touching, sensitivity training, confronta-tion, sharing food, weekend retreats, clarifying values, bull sessions, and show-and-tell are but a few of the activities known as affect. It is not suggested that any of the above activities are inherently good or bad but rather as Fibber Magee's closet, affect contains all things and is therefore all things. (p. 87)

Knicker (1977) also discussed the complexity of the concept when stating, "These approaches include character education, values clarification, moral development, motivation achievement, confluent education, a curriculum of affect, humanistic education, and transactional analysis" (p.12). Martin and Briggs (1986) agreed with these challenges when stating, "affective behaviors are difficult to conceptualize and to evaluate (p.12).

> Kaplan (1978), however, provided a framework for a definition of the affective domain as being huge and complex... (consisting) of such factors as emotions, values, attitudes, appreciations, impressions, desires, feelings, preferences, interests, temperament, integrity, character, love-of-beauty, aesthetics, and the like. Clearly, these are vague terms. They are vague in the sense they convey different meanings to different persons. (p.1)

He further defined affect by stating, "Although it is an oversimplification, it may be said that the cognitive has to do with the mind, *with thinking,* while the affective has to do with the emotions, *with feeling*" (Kaplan, 1986, p.10). Krathwohl, et al (1964) define affect as follows:

> Objectives which emphasize a feeling or tone, an emotion, or a degree of acceptance or rejection. Affective objectives vary from simple attention to selected phenomena to complex but internally consistent qualities of character and conscience. We found a large number of such objectives in the literature expressed as interests, attitudes, appreciations, values, and emotional sets or biases (p.7).

<u>Historical Overview of the Resistance to Affect</u>

The presence of affect in education has sparked much controversy. Many educators have found the teaching of affect useful. Others, have found it hard to measure (Martin & Briggs, 1986), including religious groups and some Christian parents, who view it with concern as they feel the school "is responsible for the cognitive dimensions of learning, but has little or no responsibility in the affective or values domains" (Ornstein & Hunkins, 1993, p. 222). Provenzo (1990) stated, "For the ultra-fundamentalists, secular humanism, and the humanistic programs and curriculums it supposedly supports in the schools, is being perceived as being anti-Christian and anti-family" (p. xvii). The validity and effectiveness of affective education has also been a long standing issue. Many researchers state that the presence of affect enhances cognition and thus should be present within the classroom and student attitudes toward subject matter may positively influence the degree of learning (Magger, 1968).

Combs (1962), in speaking of affective education, stated that education "must be concerned with the values, beliefs, convictions, and doubts of students. These realities as perceived by an individual are just as important, if not more so, as the so-called ... facts" (p. 200). Even so, such affective components of an overall curriculum are not always present. Kaplan (1986) offered this explanation:

> Reasons for the relatively limited emphasis on the affective areas in contrast to the cognitive are not difficult to locate. For one thing, there is the scarcity of really significant research on the growth stages of the affective domain. For another, there is the limited amount of research on the nature of the relationship between the cognitive and the affective domains. Earlier, it was suggested that there is an absence of a standard terminology. Add to this the lack of valid, standardized instruments such as tests, scales, inventories, and observational devices in affective areas. (p.10)

<u>Measures and Taxonomies of Affect</u>

Krathwohl et al. (1964) defined a classification structure which incorporates the evaluation of affective objectives. This Affective Domain Taxonomy consists of five major categories--receiving, responding, valuing, organization, and characterization. This classification system sets a continuum for affective behaviors based upon the degree to which they are incorporated into the learner's personality. Kaplan (1978) developed an observational approach for measuring affect by refining major components of the Krathwohl hierarchy. "This instrument provides forty-five (45) objectives or behaviors in the affective domain which can be used by the teacher in the development of curriculum" (p. viii).

Gee (1991) proposed a superimposition model to combine the Krathwohl et al. (1964) Affective Taxonomy with Bloom’s (1956) Taxonomy for the Cognitive Domain. In his stylized model, which can be imagined as two equilateral triangles, one base down/point up, the other immediately adjacent to the right, point down/base up. The Cognitive Domain sits inside the left triangle, its six levels numbered consecutively from the bottom, (knowledge, comprehension, application, analysis, synthesis, evaluation). The Affective Domain is in the right triangle, its five levels numbered consecutively from the bottom (receiving, responding, valuing, organization, characterization of a value). The lowest items in each are joined by dotted lines, as are the two highest items.

> The lower two levels of the cognitive domain are well-spaced in that greater periods of time are necessary for a student to sufficiently gain basic knowledge to form a reasonable comprehension of a concept. The three lower levels of the affective domain are just the opposite in that they often occur in a matter of seconds. A student receives information, and immediately has some reaction while attaching an initial value. (p. 4)

Maslow's hierarchy of needs was the basis for Brandhorst's (1978) measure of affect. Four constructs, effectance, efficacy, competence, and analytic-coping abilities, are used to define behavior. Of the 132 affective conditions Martin and Briggs (1986) list within their affective taxonomy, attitudes and values are believed to be the most important. Other conditions include the following: self-development, group dynamics, and ethics.

While the taxonomies are helpful in suggesting categories of affective components of educational curriculum, there is also empirical evidence of how teachers actually form constructs of affect in the classroom. Bohlin (1998) discovered that teachers reported, in order of most important to least, that they used motivation, anxiety (reduction), attitudes, and values/valuing as affective aspects of their formal and informal in-class teaching.

Interdisciplinary sharing of instructional design patterns have also netted applications to affective educational techniques. Johnson (1998) suggested that general education might benefit from a model derived from arts education, one which explores “the relationships between the affective and cognitive domain, leading to a change in orientation from teaching to *promoting learning*, to thinking of ways to provoke students into wanting to know more, and to seeing how the cognitive component fits into the understanding of values, emotions, and society” (p. 49). She suggests that the ultimate goal is “to empower the learner rather than to impose control” (p. 49; Greene, 1995).

<u>Other Issues of Affect</u>

In addition to creating taxonomies and patterns for identifying the affective component in curriculum, researchers and theorists have tried over the years to discover its underlying constructive foundations. As an example, McLeod (1986) proposed the following major dimensions of affective factors is they relate to problem solving:

- Magnitude and direction of the emotion - “computers add to the magnitude of affective reactions to problem solving” (pp. 4-5)
- Duration of the emotion
- Awareness of the emotion
- Control of the emotion - “Although there are some students with uncontrollable fears of mathematics or computers, most students do have the capacity to exercise come control of their emotions most of the time. But there are occasions when students will lose control of their emotions.” (p. 6)
- Types of Cognitive Processes

- Types of Instructional Environments - influence of affect will vary depending on small-group, rather than individual, instruction; also will vary according to amount of guidance provided by teacher or software, kinds of assessment students expect, etc.
- Student Belief Systems

McLeod further speculated on what the effects of affect might be specifically on the processes of computer-mediated instruction (CMI), suggesting that first for a student new to CMI might be “machine anxiety,” which “generally centers around a fear of breaking the machine” (p. 8). This usually dissipates in a couple of hours work on computer, but for some it lasts longer. Extreme machine anxiety, he suggested, is not very common among students. Other ways that the affective domain finds its way into CMI include some software attempts to sense and promulgate the “joy of making conjectures” (pp. 9-10), Finally, McLeod asserted the need for further research on the impact of both the affective component and CMI on sociological structure of the classroom, including the “changing roles of the teacher and student (p. 11).

Computer Anxiety, Self-Efficacy, and Other Attitudinal Constructs in Computer Use

As noted in the introduction to this chapter, the overwhelming majority of research investigating the confluence of the affective domain with computer-mediated instruction has centered on computer anxiety (and related issues) and gender-related differences related to computer use. This section will summarize the major research in the former of these. Considered first will be the concept of computer anxiety (e.g., definitional research centered on its factorial content, its seeming ubiquity among teachers, and remedial methodologies) and next its “mirror-image” concept of self-efficacy in computer usage (e.g., definitional issues and contrast to computer anxiety, measurement and the development of inventories, and effects of varying measured levels of self-efficacy). Examination of the other general area, gender-related differences related to computer use, is summarized in the next section.

<u>Computer Anxiety</u>

Though a large part of research into computer anxiety has dealt with the issue, there seems to be no clear consensus on what the factorial content of “computer anxiety” is. Myriad measures have been created (e.g., Bannon, Marshall, & Fluegal, 1985; Brown, Brown, & Baack, 1988; Gardner, Discenza, & Dukes, 1993; Loyd & Gressard, 1984; Marcoulides, Rosen, & Sears, 1985; Oetting, 1983; Simonson, Maurer, Montag-Torardi, & Whitaker, 1987), all claiming to measure “computer anxiety,” but their bases differ often quite markedly. One 30-item scale comprises two factors (General Computer Anxiety and Equipment Anxiety (Marcoulides, et al., 1985)) while a different inventory includes three factors (confidence in learning to use a computer, liking of computers, and anxiety or fear of computers (Loyd & Gressard, 1984)). There is one 40-item attitudinal inventory which has been shown to break down in affective, behavioral, and cognitive sub-scales (Jones & Clarke, 1994).

Noting the above, Dyck, Gee, and Smither (1998) reassessed one of the older inventories (Marcoulides, et al., 1985) by giving it to both a younger and an older sample. The two factors originally found for the inventory (General Computer Anxiety and Equipment Anxiety) transformed in the more recent study into two different ones: anxiety during indirect involvement (e.g., watching someone working at a computer terminal, talking to a computer programmer) and anxiety during direct involvement (e.g., learning to write computer programs, getting error messages from a computer). With slight variations that made Dyck et al. (1998) suggest the need for some “further examination” of the inventory, the factoring held true for older as well as younger subjects.

Tseng, Macleod, & Wright (1997) found that computer anxiety affects or is at least correlated with mood shifts. They found significantly greater computer axiety related to measured mood when the mood measurements were collected using a computerized method as opposed to a paper-and-pencil method, thus suggesting that the very act of operating the computer not only increased anxiety but also affected mood. Rickenberg (2000) studied the effect on computer users of on-screen animated characters (both characters who appeared to monitor the task being done by the users and characters who appeared on the users' screen), and discovered that levels of anxiety were highest among users who were monitored, significantly lower for those where the character merely appeared, and least for users with no animated character. This study appears to validate (and extend) social facilitation theory which would predict that presence of others (even, apparently, animated fictional characters) would exacerbate dominant behaviors and psychological states (in this study, computer anxiety).

A very large proportion of research that has been done on computer anxiety has centered around teachers. Milbrath and Kinzie (2000) noted that, in order for teachers to be effective in their use of computer technology and to be equally effective role models for their students, they must rely on what are often not strong backgrounds or training to achieve these ends. Their longitudinal study showed that time and cohort (peer interaction) were key factors in teachers achieving the expertise and self-efficacy necessary to be effective (and non-anxiety-ridden) users of computer technologies. Using a variety of measurement instruments with technical instructors, Yang, Mohamed, & Beyerbach (1999) also found that time (in this case designated as computer-related experience) was the prime influence in diminishing computer anxiety. No relationships were found between computer anxiety and a host of other variables, including age, ethnic origin, and teaching area. Reasons (1999) attempted to categorize those teachers reporting various levels of computer anxiety in a distance education setting, and discovered that female faculty reported lower levels than male faculty, full-time faculty reported lower levels than part-time, and those faculty with the most positive attitudes toward distance learning also had lowest levels of anxiety (though there is no clear indication where the causality lies). Differences based on academic department, with health professionals reporting lowest levels and science and engineering technology reporting the highest.

One of the most frequent types of study into computer axiety is that which seeks to determine the most effective remediation processes available. A study by Becker (2000) sought to determine why such a small proportion of teachers in noted surveys were evaluated as major computer users. She found that computer anxiety was reported as a key element in this avoidance, and that these levels of anxiety could be reduced (and usage increased) through interventions such as training and mentor relationships. Similar anxiety reduction was noted and verified in a study by Yildirim (2000), who found that preservice and inservice teachers who participated in educational computing classes reported significantly reduced levels of computer anxiety and avoidance. Hemby (1999) studied the ways that trainers used to reduce adults' computer anxiety, and discovered those which most successfully accomplished that goal did so by

> establishing a psychological climate conducive to learning by using humor whenever possible, demystifying the computer, determining fears, beginning with the basics, avoiding computer jargon, measuring the instructional pace, avoiding stimulus overload, avoiding instructions that sound like warnings, encouraging practice, encouraging learning partnerships, encouraging group work, reserving time for open discussion, and providing reassurance. (p.32)

In a theoretical approach to the problem, Worthington and Zhao (1999) posited that complete understanding of computer anxiety (and therefore creation of truly effective measurement instruments and remediation processes for it) has been limited because educators failed to consider two issues: "(1) that there is an existential element to computer anxiety, and (2) that computer technology has undergone historical changes that bring with them subsequent changes in the metaphors we use to understand computers" (p.299). They proposed a research-based theoretical framework they claim will inform all future such work.

Attitudes and Self-Efficacy in Computer Use

If computer anxiety is a negative psychological aversion to the use of computer technology, its attitudinal mirror image can perhaps be said to deal with a concept which has become known as “self-efficacy” in computer use. Attitudes of this sort are defined as “a positive or negative feeling or mental state of readiness, learned and organized through experience, that exerts specific influence on a person’s response to people, object and situation” (Gibson, Ivancevich, & Donnelly, 1991, p. 70) Rosenberg (1960) defined attitude as the way an individual feels about and is disposed towards some object.

In this context, self-efficacy in general (as opposed to specifically related to computer use) is a person’s attitude about his/her ability to accomplish a task. It can be thought of as a person’s “judgments of how well one can execute courses of actions required to deal with prospective situations” (Bandura, 1982, p. 122). By extension, “perceived self-efficacy could further be defined as a person’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances” (Bandura, 1986 in Olivier & Shapiro, 1993, p.81). As Olivier & Shapiro (1993) note, self-efficacy differs from self-esteem, in that self-efficacy deals with self-capability and self-esteem deals with self-worth. “Efficacy expectations can be defined as a person’s belief that he/she will accomplish the behavior required to produce a particular outcome” (p. 82).

How do people’s attitudes about their abilities to complete tasks (such as computer use) develop and blossom? Positive experiences have been found to be a factor in the presence and/or increase of self-efficacy. “As fear and anxiety diminish [e.g., computer anxiety] and positive experiences add up, self-efficacy and the willingness to cope with mastering the task will increase” (Olivier & Shapiro, p. 83). Seeing others successfully perform tasks has also been found to increase confidence and self-efficacy, and to decrease anxiety. Gist, Schwoerer, & Rosen (1989) found that behavior modeling (demonstrating the behaviors required for performance) is a more effective training method than computer tutorial training because modeling operates through self-efficacy to influence performance.

In dealing specifically with self-efficacy in computer use, numerous studies have examined the interrelationship between affecting psychological states (anxiety reduction) and influencing specific behaviors (computer use and expertise). Jorde-Bloom (1988) did a study to see if self-efficacy was a predictor of computer use. Her results showed that, while self-efficacy expectations are a strong indicator of behavior, they are not the sole determinant. Bandura (1977) stated that performance/experience was the most influential source of self-efficacy information. Lewis (1985) demonstrated that direct computer experience influences an individual’s development of self-efficacy, and may be the single most potent source of change. Based on theory which suggests that one’s beliefs about an object lead to an attitude toward it, and that attitudes are an important precursor of behavior, Levine and Donitsa-Schmidt (1997) proposed a model which posited that computer-experience, computer-related attitudes, computer-related confidence (self-efficacy), and commitment to computer learning are the causal factors for predisposition to computer usage. They suggested that computer experience positively affects self-confidence in and attitudes toward computer use. Further, they maintained that computer attitudes and confidence affect one other, also positively, and that both lead to commitment to computer learning.

As is the case in most psychological areas, the accuracy of measurement is at the mercy of the devices used to measure, and several studies have attempted to determine the "efficacy" of and factors inside current measures of self-efficacy in computer use. At least three studies have attempted to find out the underlying factors which make up "computer attitudes" by combining existing inventories from the literature and subjecting results to factor analysis. Violato, et al., (1989) selected portions of two existing inventories (Richard, et al., 1986; Gressard & Loyd, 1986) and factor analyzed results of administering the new inventory in an effort to demonstrate a preconceived four-factor model. The four factors (Comfort, Liking, Sex Differences, Value) were confirmed. McEneaney, et al., (1994) combined four inventories (Griswold, 1983; Gressard & Loyd, 1986; Stevens, 1980; Reece & Table, 1982) and performed a factor analysis on the composite 71-item inventory. The resulting four factors (general attitudes toward computers, positive feelings for computers, understanding of the utility of computers, and negative feelings for computers) did not seem to correspond to other conceptualizations. Francis (1993) used a similar procedure toward a different end, combining five inventories (Griswold, 1983; Stevens, 1980; Gressard & Loyd, 1986; Reece & Gable, 1982; Bear, et al., 1987) into a single 97-item inventory. Factor analysis was used to find the scales making up the one largest loading factor, and these 24 items were combined into an Attitude Toward Computers Scale.

The work of Krech, Crutchfield, and Ballackey (1962) led Triandis (1971) to suggest that attitude comprises affective, cognitive, and behavioral components. In a study utilizing Saudi Arabian college students, Al-Khaldi and Al-Jabri (1998) joined the Computer Attitude Scale (CAS) of Loyd & Loyd (1985) with this theoretical tripartite nature of attitude in an attempt to determine the effect of attitude on computer use. The CAS has four sub-scales, which Al-Khaldi and Al-Jabri equated with the three parts of attitude in the following manner: computer anxiety, computer liking (these two represent the affective part of attitude), computer confidence (representing the behavioral), and computer usefulness (partly representing the cognition part of attitude). The study produced results that indicated that computer use was most strongly predicted by the sub-scale liking, and next by confidence. Anxiety and usefulness were not found to be significant predictors of computer use.

Use of the Bath County Computer Attitudes Scale (Bear, Richard, & Lancaster, 1987) by Yaghi (1997) found that pre-university-age students' attitudes toward computers were at significantly increased levels in tandem with at least three factors. High levels of experience in computer use ($p=0000$), higher frequency of use ($p=.0000$), and multiplicity of training venues (e.g., parents, relatives, and school, as opposed to school only) ($p=.0006$) were all found to be significantly matched with higher level self-reported attitudes toward computers. Though there is a minority among researchers who have found experience negatively correlated with attitudes (e.g., Proctor & Burnett, 1996), most research bears out the supposition that experience positively affects attitudes toward computers and reducing computer anxiety (e.g., Ayersman, 1996).

Levine & Donitsa-Schmidt (1997) explored an hypothesized causal model relating measures of computer experience, computer-related attitudes, computer-related confidence, and commitment to computer learning. They found that

> computer experience has a positive effect on both computer confidence and attitudes toward computers. Furthermore, as predicted, a crossover effect was found between computer confidence and computer attitudes; and computer attitudes were found to positively effect computer-based commitment to learning.

> *However, contrary to prediction, computer confidence was found to exert a strong negative effect on commitment to learning computers rather than a positive one.* [emphasis added] (pp. 95-96)

In an attempt to create an instrument to measure attitudes towards computers and computer learning, Selwyn (1997) discovered that factor analysis on scales in that instrument produced four distinct factors in computer attitude:

- Affective component: “afraid, hesitate, apprehensive, uncomfortable, scare, stupid”
- Perceived usefulness component: “organize, productive, interesting, imaginative, enhance… work”
- Perceived control component: “teach myself, what I want to do, solve problem myself, control, experienced person nearby, tell me what to do”
- Behavioral component: “avoid, come in contact, use” (p. 37)

Selwyn suggested that the discovery of these factors might have beneficial remediation value for instructors who attempt to deal with wide ranging or unusual attitudinal bases concerning computers in their students.

Empirical evidence was found for a number of theoretical constructs related to computer usage. For example, results suggested that, “while there is a fairly high correlation between computer attitudes and computer confidence, these variables should be treated separately, i.e., as different psychological constructs” (p. 97). There tends to be more of a construct alliance between computer self-confidence and anxiety than between either of these and computer-related attitudes. Since this idea is supported by the concept that, essentially, anxiety and confidence measure the same construct (e.g., Pope-Davis & Vispoel, 1993; Woodrow, 1991a), doubt is cast on the idea (and often occurring practice) that inventories to measure computer-related attitudes contain a sub-scale of computer self-confidence. That computer-related attitudes and computer confidence exerted opposite influences on commitment to computer learning also tends to underscore the difference, at least in polarity, of these constructs.

Zoller & Ben-Chaim (1996) examined a construct called “Computer Inclination,” which they defined as containing three components: (a) comfortable attitudes/feelings towards the computer, (b) belief in the importance and utlity of the computer, and (c) educational benefit assigned to the computer. These three affective-laden components individually were shown to differ significantly between students and teachers (a: $p<.01$, b: $p<.001$, c: $p<.05$); among students’ courses of study (science, social studies, technology) (a: $p<.0001$, b: $p<.0001$, c: $p<.0002$); student gender (a: $p<.0001$, b: $p<.0004$, c: $p<.025$); and, to a far lesser degree, teacher gender (a: $p<.10$, b: n.s., c: $p<.02$).

Educational uses of computers, and the self-efficacy of both students and faculty, have been key targets for several research studies. Shoffner (1990) discovered that, in fifth- through tenth-grade students, home environment was a better predictor of attitudes toward computer learning than a predictor of student achievement. The corollary to this, she asserted, was that “the home environment could be effectively altered to cultivate positive attitudes toward computer literacy” (p. 6), which might increase the likelihood of success in technologically based learning. A study by Shelton (2000) determined that, at the college freshman level, courses in word processing and access to computers were primary predictors of students' levels of self-efficacy about computer use and their levels of computer anxiety. Computer attitudes seemed most to correlate with time on task and experience using computers, suggesting further ways for improving levels of self-efficacy. Dusick (1998) delineated factors that cause faculty to be reluctant to adopt computers and revise their pedagogy, which he found included personal and behavioral factors of attitude and anxiety, self-efficacy, willingness to make a time commitment and take personal risk, computer competency, beliefs, knowledge, and perceived relevance.

Milbrath and Kinzie (2000) posited that faculty, in order to be effective users of computer technologies and be models for students' computer use, must have positive computer attitudes and feel self-efficacious in using them. Just as it proved (see above) in the abatement of computer anxiety, they found that computer training that teachers receive through their teacher education program is likely to foster positive computer affect.

Gender-Related Issues in Computer Use and Computer-Mediated Instruction

As noted in the introduction to this chapter, the overwhelming majority of research investigating the confluence of the affective domain with computer-mediated instruction has centered on gender-related differences related to computer use and computer anxiety (and related issues). This section will summarize the major research in the former of these. Considered first will be the theoretical framework which surrounds and underpins gender-differentiation research, followed by an examination of the results of specific gender-related studies (including their implications for cognitive learning, and of studies from American and international sources), and finally by a survey of studies which sought to provide rationalizations, explanations, and remediations for gender differences found in previous studies. Examination of the other general area, computer anxiety and related issues, is summarized in the previous section.

The literature does not yet contain theory that sufficiently ties the varying results of empirical research extant on gender-related issues related to computer use and computer-mediated learning. The very question of whether there even are any gender-based differences is called into question: some studies purport to show it, some tend to diminish it (or show it diminishing), and some tend to find it and seek for ways explain it away (e.g., socialization) (Makrakis, 1993). Whatever the over-arching and unifying explanation turns out to be, there seems little doubt (based on the research itself, and the parameters used therein) that affective issues will play a large part in it. So many of the studies are tied into attitudinal and valuing vectors (e.g., anxiety, self-efficacy, even the “genderness” of the computer medium itself) that they merit review in a study related to the affective component of computer usage and computer-mediated learning.

Theoretical Framework. Whitley’s (1997) meta-analysis of 92 studies of gender differences in computer-related attitudes and behavior divided “attitudinal” measures into five categories:

- Affect measures assessed emotional responses to computers, including such constructs as anxiety, liking, and fear.
- Belief measures assessed agreement or disagreement with positive and negative statements about computers and their perceived effects on people and society.
- Self-efficacy self-confidence measures assessed respondents’ feelings of being able to competently operate or otherwise deal with computers.
- Mixed content measures assessed more than one of the preceding types of attitudes and separate effects sizes could not be computed for each type.
- Sex-role stereotype measures assessed beliefs about the degree to which computer use was perceived to be more appropriate to men and boys than to girls or women, or which assessed the degree to which men and boys were perceived to have more computer-related skills than women or girls. (p. 5)

Elements of all of Whitley’s categories can be found to fit Kaplan’s (1986) definition of affect as it relates to education. The study demonstrated attitudinal differences across all age groups (adult, college, high school, and grammar school), with the higher differences reported in high school. In general, the meta-analysis showed that “men and boys reported more positive attitudes, held more sex-role stereotypic attitudes, and engaged in more computer-related behaviors than women and girls" (p. 6)

> The largest difference was for sex-role stereotyping, d=.541, followed by self-efficacy, d=.406, and affect, d=.259. Boys and men, compared with girls and women, saw computers as more appropriate to themselves, saw themselves as more competent on computer-related tasks, and reported more positive affect toward computers. (p. 12)

The overall meta-view afforded by such studies demonstrates that there appears to be a "systemic" affective difference in the perceptions of females and males concerning computer use, but individual studies, with more surgical views of the phenomena at work, begin to show exactly what this affective difference in gender may look like.

Conceptual aspects of Whitley's findings were confirmed by Young (2000), who studied gender-related differences in computer usage through the development of a student computer attitude survey. She predicted five factors, and they were confirmed by the results of the study:

- Confidence
- Perception of computers as male domain
- Positive teacher attitudes
- Negative teacher attitudes
- Perceived usefulness of computers (p.204)

Males were seen to have greater confidence than females, and computers were perceived to be a male domain by males and not by females.

Specific Gender Studies. Busch (1995) found that the only difference between males and females is their self-confidence, not their liking for computers. A series of earlier studies using various inventories measuring some aspect of computer attitudes have found significant differences between genders in primary school students (Siann, et al., 1990; Todman & Dick, 1993), secondary and high school students (Chen, 1986; Collis, 1985; Levin & Gordon, 1989; Martin, 1991; Wilder, et al., 1985), pre-service teachers (Dambrot, et al., 1985; Sigurdsson, 1991), and teachers (Loyd & Gressard, 1986). In contrast, an equally impressive number of studies found no significant gender differences on similar computer attitude inventories in Harvey & Wilson, 1985), high school students (Gressard & Loyd, 1987), pre-service teachers (Koohang, 1987; Woodrow, 1991b), undergraduate students (Francis, 1993; Arthur & Olson, 1991; Rosen, et al., 1987), and teachers (Marshall & Bannon, 1986). Dooling (2000) found gender-related differences of degree in the level of confidence students expressed in their own abilities to use computers. And Todman's (2000) longitudinal study into the varying levels of computerphobia (computer anxiety) over time also demonstrated that, while computer anxiety levels overall have been declining in recent years, there has been a widening of levels between females and males ($p<0.01$). Females at the high-scoring (high anxiety) end of the scale has been increasing significantly ($p<0.001$) from 1992 to 1998. Studying the literature over roughly the same time period as Todman's study, Butler (2000) found that "gender emerged as a consistent factor that affected attitudes toward computers. Specifically, it became apparent that boys had a more positive attitude toward computers than girls." Further, "results from research conducted in the late 1990s revealed that the gender gap still remained" (p.225).

Al-Motrif's recent study (2000) demonstrated that, at least on one typical American university campus, males still tend to dominate use of the Internet in all of four identified categories, instruction/learning, research, communication, and entertainment. Females, however, were seen to be using the Internet at significant levels (though less than their male counterparts) for research and communication. So wide were these gaps that he defined gender as one of two major and effective predictors of use of the Internet by university students. Noting a shortage of women in the academic and professional field of computer science, Wilson (2000) attempted to determine any existing gender-related differences in factors which might predict success in early computer science courses. Out of 12 posited potential predictors of success (including self-efficacy and previous experience, both computer related and non-computer related), only three emerged as significant: comfort level, math experience, and attribution to luck for success/failure. Among these three, no significant gender differences were found. Jenson (1999) documented the process and results of an intervention project undertaken to increase the level of computer-based competencies and peer-tutoring experiences provided for female students only. Results of the program showed dramatic increases in student and peer recognition of increased competency, but also in teacher perceptions of female students in general. The use of gender specific interventions, segregating females, was seen as a key way to increase females' technological competence and skills.

Robertson, et al., (1995) surveyed male and female students on seven differing constructs, in an Attitude inventory pulled together from three separate ones (Jones & Clarke, 1994; Gressard & Loyd, 1986; Griswald, 1983), and found substantial differences in the various sub-scales. Males reported higher mean responses than females on the Attitude inventory as a whole (p=.0419), and on these sub-scales:

- Confidence (e.g., “I’m sure I could do good work with computers”; p=.031)
- Behavior (e.g., “I would like to spend a lot of time using a computer”; p=.0023)
- Computer use (e.g., “computers will improve education”; p=.0317)
- Competence (e.g., “I sometimes show other people how to use a computer”; p=.0317)
- Cognitive attitude (e.g., “people that use computers are seen as being more important than those who don’t”; p=.0331)

No significant gender differences were seen in these sub-scales:

- Anxiety (e.g., “I don’t feel as if I know what I’m doing when I use a computer”; p=.4187)
- Liking (e.g., “I think I would enjoy working with computers”; p=.879)

Similar differences were found when student and faculty scores were tested: significant differences were found (with students uniformly higher except on Cognitive attitude) on the Attitude inventory as a whole Anxiety (p=.0066) and in the sub-scales Anxiety (p<.0001); Confidence (p=.0153); Behavior (p=.0151); Liking (p=.0012); Computer use (p=.0389); and Cognitive attitude (p=.0351). No significant differences were found between students and faculty in the sub-scale Competence (p=.7444) (Robertson, et al., 1995, pp. 75-78).

Prior to and after a basic-level course on the fundamentals of computers, Shashaani (1997) surveyed college men and women on four aspects of their attitudes: computer liking, computer confidence, computer usefulness, and computer stereotype. Both before and after the course, females reported themselves significantly lower on two of the sub-scales, liking (pre p=.001; post p=.01) and confidence (pre p=.004; post p=.003), though they registered a higher level of belief on the concept gender equality of computer users (pre p=.01; post p=.01). Both males and females tended to agree that their parents believed computers were more appropriate for males, and males reported more encouragement from parents to study and use computers. In a prior study (Shashaani, 1993), females were found to be less interested in learning about and using computers, which seemed to tie into a significant gender difference in self-confidence in the use of computers. Though females tended to indicate that women have equal competencies in computer use, “girls reported fear using computers and feeling helpless around computers” (p. 169).

Dissimilar results were found by Francis (1994) who used the Computer Attitude Scale developed by Gressard and Loyd (1986) plus two additional individual items related to gender roles in computer use to examine gender-based attitudes both toward computer stereotyping and toward personal computer use.

> Only a small minority of students held gender stereotyping views of computer use. Among this minority more female students tended to think that women were better at using computer than men, while more male students tended to think that men were better at using computers than women. (p. 283)

The Computer Anxiety Scale breaks down into three sub-scales (Anxiety, Confidence, and Liking), and on none of the four (sub-scales plus inventory as a whole) was there any significant difference found between males and females.

Gressard and Loyd are by no means the only researchers not to find gender-related differences in this area. Schott and Selwyn (2000) found that, inside a peer group of grade 12 students, there was no statistically significant gender-related difference in the composition of students who describe themselves to be highly oriented toward use of computers. Mathews and Guarino (2000) found no gender-related differences in the areas of computer literacy and computer ability, and neither did Clay-Warner and Marsh (2000), who queried students about their openness to and (as a follow up) positive experiences in computer-mediated learning experiences. Riding and Grimley (1999) found no significant gender-related differences in their study of cognitive styles and learning performance in a computer-mediated venue. Similary, Clay-Warner and Marsh (2000) found no gender-based differences in students' willingness to use elements of computer-mediated communication in the college classroom. Inoue (2000) was unable to find any gender-related differences related to preference for computer-mediated learning, although he found that graduate students did prefer it more than undergraduates. When testing a new computer-mediated version of the Graduate Record Exam (GRE), Bennett, Morley, & Quardt (2000) found no statistically significant difference in the performance of females and males on the new version, except those gender-related differences already accounted for in quantitative areas. Grace (2000) examined students in a first-year French class to see if any specific aspects of computer-mediated learning in that program would be affected by gender-related issues. She found no differences on their short- or long-term retention test scores, nor in the amount of time males and females spent accessing translations. Charlton (1999) took an opposite approach to computer anxiety, defining its mirror image or inverse called computer comfort, as well as engagement (how much dedicated use) and over-use. His study revealed masculine and feminine personality types find equal amounts of computer comfort and engagement, though males tend to over-use. He took this as a sign that female negativity towards computers is waning.

Nevertheless, gender-related differences do appear in the literature, and these attitudinal and affective gender-related differences are not limited to self-conception. Lee (1997) used elements of a larger study to pull gender-specific information on the use of computers in schools. Among the findings of that study were these generalizations:

> Men are, as a group, more active in computing and their activity covers a wider range of tasks or applications than occurs amongst women. They are more confident about using computes. Not surprisingly, from this perspective, they are also likely to complain more loudly about impediments to their effective use of computing. Women, by contrast, tend to be less active users due to their lack of computing experience. They are distinctly different to men in regard to the type of software they are drawn to using. Generally they report lower levels of computing use and are more likely to blame themselves for their lack of confidence. They

> are also more willing to obtain expertise from external sources and often opt to pay for such courses from their own income. (p. 253)

Lee also notes a larger tendency in men than women to complain about inadequacies in computer set-ups in schools, while women “more often report human resource problems” (p. 253) related to lack of computer knowledge.

The gender-related differences found in affective and attitudinal aspects of computer usage were also seen to have implications for cognitive learning and behavioral performance. In a study of collaborative learning using computer-mediated instruction for sixth-grade students, Edwards, Coddington, & Caterina (1997) found that the socialization aspect of the project worked well, but discovered some gender-related differences worthy of note. Pairs and trios of students, “particularly those including boys,” tended not to work in a fully collaborative manner, but rather “negotiated a division of labor early in the process” (p. 45). In addition, girls generally “worked somewhat more autonomously and doggedly than did the boys” (p. 45), while boys tended to call for help more often. These results contradict findings in a previous study, using the identical computer-mediated instructional collaborative learning software package. In that study, Sutherland and Hoyles (1988) found that girls worked more cooperatively than boys, and did not fight for control within their groups. Boys tended to try to figure out problems on their own, and girls expressed enjoyment at group activities. In both studies (Edwards, et al., 1997; Sutherland & Hoyles, 1988), girls were found to be “generally more well-behaved than the boys, and expressed more emotion and ‘bonding’ with their projects” (Edwards, et al., 1997, p. 46).

<u>International Studies</u>. In countries outside of the United States, the problem of gender equity in the use and perceptions of computers appears from the literature to be equally evident and perhaps more pronounced. Janssen Reinen and Plomp (1997) used data collected from ten North American, European, and Asian countries, from students in elementary, lower secondary, and upper secondary school grades, and determined that “the concern about gender equity expressed by many educational practitioners are right. Females know less about information technology, enjoy using the computer less than male students, and perceive more problems with software” (p. 65). While finding the United States is the most “gender equal” (p.77) country among those examined (explained by parental stimulation and availability/use of computers outside school), it was noted that gender differences occur both inside and outside school across all geographic regions. A study on similar data found the gender of students to be a factor with substantial influence on student achievement in these countries (ten Brummelhuis, 1994).

In a longitudinal study (1986 through 1995) in the United Kingdom (a country not studied in the above reports), Durndell and Thomson (1997) found statistically significant and continual gender differences in these scales relating to reasons why students have not and are not studying the use of computers: “I am not qualified to study computing,” $p<0.05$, “I would have difficulty getting a job with a computer qualification” $p<0.001$, “males can be hostile to females with abilities in computing” $p<0.001$, and “computing has a rather unfeminine image” $p<0.05$.

> Three years of testing results were significant, in all three cases with gender variation remaining constant and the 1995 sample giving more weight to the item: “I am not qualified to study computing” $p<0.01$ (in fact they all were qualified to study computing), “computing has a rather unfeminine image” $p<0.05$, and “I am more interested in people than objects” $p<0.001$. (p. 5)

Though it is unclear which way (if any) a causal relationship exists, the same longitudinal study demonstrated a significant and continual gender difference in amount of time of computer use at school, at home, and at friends’ houses. In addition, Yaghi (1997) found a statistically significant (though small) gender difference in pre-university-age students on the means of the univariate

Bath County Computer Attitude Scale (Bear, et al., 1987). Previous studies using this same inventory were mixed in finding gender differences, with some finding no gender differences (e.g., Francis & Evans, 1995; Katz, Evans, & Francis, 1995; Dyck & Smither, 1994) and some finding significant gender differences (e.g., Koohang, 1987; Colley, Gale, & Harris, 1994). Cultural differences were suggested as a possible explanation for these varied findings (Yaghi, 1997).

Kadijevich (2000) discovered that high school boys in a gymnasium oriented toward natural sciences and mathematics reported a significantly more positive attitude towards computers than girls. This was true even when self-reported levels of experience in computer usage were taken into account.

In a study of 15-year-old Japanese students, Makrakis (1993) replicated what has come to be called the female "we can, I can't" response to computers (Collis & Williams; 1987; Hattie & Fitzgerald, 1987; Siann, et al., 1990), which is a tendency for females "to be unsure of their own individual ability to use computers, but to feel that women as a group in general are as able as men in learning about computers" (Makrakis, 1993, p. 191). Using scales that asked about both current and future self-efficacy in relation to computers (e.g., "I feel confident with my ability to learn about computers" and "In the future, I shall be able to learn computers well"), as well as scales dealing with gender competency in computers,

> female students reported making judgments of their gender equality in computer competence significantly more often than they reported making judgments for their current or future self-efficacy, [p<0.001 in both cases].... Only 18% and 14% of girls were positive about their current and future ability in computers respectively, compared to 60% who agreed that "girls can do just as well as boys in learning about computers." (pp. 193-4)

Interestingly, males and females did not differ significantly in their ratings on current self-efficacy, although responses to future self-efficacy scales were found to be significant in favor of males.

Reactionary and Explanatory Studies. Some studies have attempted to find reasons or rationalizations for any perceived gender-related differences in use of computers and in computer-mediated learning. Working on the stated premises that "all students, regardless of gender, cultural, or racial background, must be familiar with computers and how to use them," Harrell (1998, p.46) posited that those denied access to computer-based information systems will be extremely disadvantaged in the 21st century. As regards gender, he stated that, while it is true that research shows girls to be often less positive about computer use than boys and often are more negative in their feelings about their use of computers than boys, research also demonstrates that gender bias vanishes when girls are given the opportunity to discover the relevance of computer usage in their own lives through discovery means most suited to their learning styles. In noting a gender gap reported in the literature, McCullough (2000) posited that these findings have been based on quantitative data collected most commonly from Likert-style attitude surveys on computer usage and skill. He examined data collected from a widely used Likert-type instrument, the Computer Anxiety Scale (Revised), and found that it showed males reporting significantly lower levels of computer anxiety than females. By contrast, however, results from an open-ended instrument, the Computer Anxiety Questionnaire, showed no statistically significant gender-related differences in computer anxiety. His analysis of the process revealed that

> neither research design was entirely right, or entirely wrong. The Likert-style instrument seemed to define computer anxiety in broad terms, somewhat mirroring each subject's conception of societal views regarding computer anxiety.

> The open-ended questionnaire appeared to define computer anxiety in more specific terms, explaining it based on the computer situation at hand. (p.195)

Crombie, Abarbanel, and Anderson (2000) looked at both single-gender computer science classes composed of only females, as well as mixed-gender classes, to test their perceptions on their own abilities, self-efficacy, and teacher support. Both females in the single-gender classes and males in the mixed-gender classes reported similar levels of support from teachers, females in the mixed-gender classes reported less perceived supports from teachers. It was suggested that this may be a cause of, or a result of, stereotyping and socialization on the part of teachers. Participation in single-gender classes also seemed to have a positive effect on attitudes and future intentions related to computer usage. A seven-year case study by Mayer-Smith, Pedretti, and Woodrow (2000) discovered that “sound pedagogical practices and social organization in technology enhanced secondary science classrooms can promote a gender inclusive experience, where women and men participate and perform equally well” (p.51). A study by Bhargava, Kirova-Petrova, and McNair (1999) found discrepancies in relation to female and male access and use of computers in classrooms, and they suggest this mismatch could be the progenitor of gender biases and stereotypic behaviors that are also observed. They also note the lack of female role models, a perceived computer gender gap in homes, and the scarcity of bias-free software programs as causal factors.

Computer-Mediated Instruction

This section summarizes major research published concerning the specific area of computer-mediated instruction (and, hence, computer-mediated learning), in order to understand what is known about it as a separate and distinct concept inside education. Considered will be definitional attempts, the measured effectiveness of the process, the process of measurement and assessment within CMI, and an extended look at the confluence of the affective and cognitive domains within CMI.

Definition

Research reports confirm that computer-mediated instruction (CMI) has increased at a steady rate in use inside classrooms throughout the United States and the world (e.g., Balasubramanian and Kadhiravan, 1999; Brooks, 2000; Caissy, 1987; Larkin & Chabay, 1992; Poole, 2000; Ross, 1991; Senn, 1983; Walker, 1983; Wright, 2000). The promise that online computer-mediated instruction will "revolutionize how students, faculty, researchers, and the public access and use information" (McIntyre & Wolff, p. 255) has given educators new ways to customize and share unique approaches to teaching and information resources.

Definitions of CMI vary in the literature, but center around two or three main concepts. Varner-Quick (1994) offered a simple definition, calling it "any method of learning in which the computer is the primary delivery system" (p. 21). Burke (1982) pointed out that the terms “computer-based instruction” and “computer-managed instruction” are also used to describe virtually the same application, though CAI seems to have emerged in the literature as the nomenclature of choice.

Santoro (1995), seeking to place it within the context of the larger concept of computer-mediated communication, offered a more technical definition:

> The main idea behind CAI is that most instruction can be systematized into an algorithmic process. Once this has been done, it is possible to write a computer program to interactively deliver the instruction. In addition, the program will periodically test the student to ensure that the desired material is being learned. (p. 25)

Szabo (1995) described CMI as "an advanced form of human-computer communication," He cited Bloom's (1984) earlier work which showed that the intelligent one-on-one human tutor is more effective than other forms of instruction, and suggested that CMI "attempts to use the computer to 'capture' some of the essence of the effective tutorial environment" (p. 170).

When CMI is merged with the ability afforded by computer technology for real-time interaction and conferencing, the resulting discipline is called distance education. Paulson (1987), himself a pioneer in the international development of distance education CMI, summed up the potential for this medium: "My proposition is that it is possible to create a virtual school around a computer-based information system and that virtual schools will dominate the future of distance education" (p. 72).

Effectiveness and Affect

Despite Paulson's rhapsodic encomium concerning CMI (see above), researchers and theorists have been mixed in their assessment of CMI as the be-all and end-all of the future of education. Ingram (1994) noted the impotence of CMI alone to be a panacea for the woes of education. "The human ingredient is critical to the teaching/learning process" (p. 116). She noted that merely sitting a student in front of a computer and expecting true education is "naïve at best" (p. 116). Ceding computers' ability to store, transmit, and organize information,

> they cannot yield the products of higher order thinking, and experience, namely wisdom, truth, and goodness. It is the human teacher who analyzes the uniqueness of the individual learner, determines what is most useful and worthwhile to be taught, and then motivates and inspires students to work at the task of learning. (p. 116)

By contrast, Santoro (1995) identified two major advantages of CMI: "(a) the ability of a student to learn at his or her own pace, and (b) the effective distribution of in the instructional process to the student, reducing this load on a human teacher" (p. 25). Another area in which CAI has been shown to be effective is in overcoming aversion to or apprehension about technology. Hogan (1994) discovered that 55% of the people he studied reported some form of technology phobia, and Donoho's (1994) study reported that 36% of people who use computers for business report feeling inadequacy over their skill levels. Both studies noted the efficacy of computer-based training and experience to overcome these challenges.

Further areas in which CMI has been found to be effective have been proposed and reported. Ellsworth (1995) examined the effectiveness of CMI and, more inclusively, computer-mediated communication, on both alpha and beta learning inside the classroom. She defined alpha learning as "the major exposition of the concepts, ideas, facts, and processes" and beta learning as "reinforcement or adjunct to the alpha learning," for example "the assignment of homework using a data set" (p. 30). While expecting that CMI would be beneficial particularly in beta learning (as reinforcement), she found it useful in both. Shimabukuro (1995) has argued that, because of the computer medium's increasing influence in education,

> students and teachers will communicate primarily through the written word. This could imply that: (a) writing across the curriculum programs must be emphasized, as it is on most campuses; and (b) researchers must examine the medium and assess the impact of CMC [computer mediated communication] on the writing process and its outcomes. (pp. 49-50)

At least four meta-analytic studies (Kulik, Kulik, & Cohen, 1980; Kulik, Kulik, & Schwalb, 1986; Lee, 1990; Niemiec, Samson, Weinstein, & Walberg, 1987), pulled together the results of hundreds of studies into the relative effectiveness of CMI and conventional instruction, and resulted in at least three major conclusions.

> First, achievement is modestly but significantly better under [CMI]. Second, learning efficiency or amount learned per unit time is strongly and significantly better under [CMI] (studies have reported reductions in learning time of 20% to 33%). Finally, student attitude toward learning and content is significantly and positively affected by [CMI]. (Szabo, 1995, p. 172)

CMI has been shown to be effective even in nontraditional uses. Burda, et al., (1995) studied the effects of using computer-assisted psychoeducation, a particular form of psychotherapeutic intervention involving imparting information to patients for use in their treatments, and found that CMI worked startlingly well. “Subjects who received computer-assisted psychoedcuation had significantly higher rates of passing classroom tests and significantly lower rates of absenteeism in the classroom” than the subjects who received cognitive training on the computer (p. 133).

The worthiness of CMI has also been demonstrated to help train pre-service teachers in simulations of actual classroom experiences. DeFalco, et al., (1994) used this method both to create computer-simulated “pupils” with whom the pre-service teachers interacted as in a traditional lesson teaching situation, and to monitor, analyze, and rank those interactions. It was possible for those running the simulation to pinpoint specific remediations required for individual pre-service teachers prior to sending them out into the field.

CMI has been shown by a series of researchers and classroom teachers to have specific characteristics, some of which are analogous to traditional classroom experiences, and some of which set it apart. Din (1996) demonstrated that students’ duration of time spent in off-task behavior during CMI was notably lower than that in seatwork. Saye’s (1997) two-year study showed that students and teachers alike, when queried concerning their beliefs and experiences with CMI, tended to base their responses on an acceptance of and preference for traditional learning environments rather than an embracing of any notions of a revolution in teaching/learning methodologies. “They are open to learning through media other than traditional text and lecture formats, but such acceptance is a more comfortable means to the same goal: for the majority, technology offers liberation from labor and uncertainty, not educational empowerment” (p. 6). Only a minority of students expressed desire for CMI as a facilitator of student-centered inquiry.

Access to computers and availability of software have been universally found to be positive influences (affective) in use of and valuing computers, and in particular CMI. Zammit (1992) posited access and availability to be primary encouragers of use of computers in classrooms. These were followed by the teacher’s self-motivation to keep up to date, value attached to the belief that students must use modern technology, and a supportive computer coordinator. By contrast, factors found most to discourage use of computers in classrooms were difficulties in access to computer room, not enough computers for individual use, not enough time to review software adequately, and quality of software. Moore (1991) found that teachers are more likely to use computers and to specifically include computer usage in their written lesson plans if the computers were physically located in the classroom, as opposed to being stored in central locations such as labs or other remote sites. Other motivating factors were found to include administrative requirements for computer usage, the presence of computer or lab assistants, repair support, and selection of software.

<u>Measurement</u>

In attempting to find ways to assess the benefits of CMI in general and the efficacy of specific CMI lab installations in particular, Newby & Fisher (1997) created a Computer Laboratory Environment Inventory (CLEI), based on the Science Laboratory Environment Inventory of Fraser, Giddings, & McRobbie (1993) and merging it with findings from interviewing computer laboratory instruction professionals. Pilot testing and factor analysis yielded a 35-item inventory, the five factors of which are perhaps its most revealing aspect:

1. Student cohesiveness (extent to which students know, help, and are supportive of each other)
2. Open-endedness (extent to which the laboratory activities encourage an open-ended divergent approach to use of computers)
3. Integration (extent to which the laboratory activities are integrated with non-laboratory and theory classes)
4. Technology adequacy (extent to which the hardware and software is [sic] adequate for the tasks required)
5. Material environment (extent to which the laboratory is suitable and available for use) (p. 183)

Newby & Fisher (1997) created an Attitude Toward Computers and Computer Courses (ACCC) inventory was created to complement the CLEI. Based on the content of three pre-existing inventories (Gressard & Loyd, 1986; Koohang, 1989), its four factors mirror those of its antecedents: Lack of anxiety, Enjoyment, Usefulness of computers, Usefulness of course.

Including measures of students' attitudes (affect) as a subset of the tools used for assessing the effectiveness of CMI has not been universally accepted as worthwhile. Draper, et al., (1996) reporting finding that "learning gains are a far more important outcome in most teachers' view, and attitudes are very weak as a measure of that educational effect" (pp. 21-22). They reported that this stems from current student self-report perceptions that CMI ranges from "state of the art material that they were privileged to experience" to those who felt it "a device by negligent staff to avoid the teaching which the students had paid for" (p. 22). Even measuring a shift in attitude, using pre- and post-measures, will not necessarily filter through much information on the efficacy of the CMI.

> A big positive shift could just imply that the student had been apprehensive and was relieved by the actual experience; a big negative shift might imply they had had unrealistic expectations, and no shift would mean that they had accurate expectations but might mean either great or small effectiveness. (p. 22)

They suggested, however, that attitudes were important to measure, as teachers would want to respond to them and attempt to manage them.

Valois, Frenette, and Villeneuve (2000) noted the need for the development of an appropriate and accurate attitude scale towards computers for students, as a tool for improving and modifying CMI curriculum. They examined the factorial structure (affect, behavior, and cognition) of the Computer Attitude Scale for Secondary Students (CASSS), and determined how well the test and its items discriminate in their measures, finding it to be a highly reliable instrument. Ward and Newlands (1998) suggested that, while the growth of higher education on the World Wide Web was "increasing at an exponential rate" (p. 171), research on the quality and nature of learning in that format was not keeping pace. Their study of Web-based instruction versus face-to-face lectures found that students found technologically-based learning was convenient and reliable, but that they had not mastered the uniqueness of online learning (e.g., students would print out hard copies of Web materials, rather than using them on line). Their conclusions were that that transition to fully integrated learning on line was in its infancy, and that both students and instructors would need to continue to master new skills sets in order to find the optimum uses of the new medium.

The Affective Component of CMI

At first glance, it might seem as if there is no affective component of CMI, because the theoreticians and pedagogists who are its chiefest proponents seem to have ignored affect in their constructs. Welsh (1999) analyzed and created a taxonomy to explain the theoretical underpinnings of distributed learning; Firdyiwek (1999) examined the integrated pedagogical components of the leading Web-based courseware systems; and Mayer, et al. (1999) asked (and answered) "What do children learn from using computers in an informal, collaborative setting?"--all without ever mentioning any of the potentially strong inherent affective aspects of CMI.

By contrast, Orabuch (1992) reported, among other findings relative to affect and using measures of affective domains, that CMI is more effective in enhancing affective domains than cognitive domains. While it is not yet clear where the causal relationships lie, it is nevertheless also true that several studies have reported high student satisfaction with CMI, its process, and its outcome (e.g., Askar, et al., 1992; Heywood & Norman, 1988; Johnston, 1987). In some cases, however, this high level of attitudinal satisfaction with CMI is not found. Boone & Gabel (1994) discovered in a longitudinal study of pre-service teachers that their attitudes became significantly less positive over the time that they used them in their studies. Theory has not been advanced that would explain this seemingly uneven level of positive attitudes toward CMI. Out of a total of six advantages and/or benefits of online CMI identified by college students (undergraduate and graduate), three contained clearly definable affective components: "motivation/impetus to learn more; learning to use communication; and convenience" (Daugherty & Funke, 1998, p. 31).

While not attributing the final results to affective components (or their lack), Luk (1998) sought to see if the cognitive styles of field-dependent and field-independent could be modified as a result of a period of collaborative-learning-based distance CMI. These two cognitive styles have affective components as part of their definitions, where concepts such as "social skills, attitudes, perceptions, and feelings" (p. 152) continually arise. After one year of the CMI program, levels of field-independence rose among the population. As indicated, Luk offered no affectively based explanations for this occurrence.

Affective components sometimes arise through ancillary or incidental aspects of larger studies. As one part of the follow-up to a study on the effect of individual learners versus learning dyads in CMI segments, students were asked their attitudes on various parts of the CMI experience. They indicated somewhat strong enjoyment of the computer lessons, and a high value on and liking of "having the option to control parts of the computer lessons" (Crooks, et al., 1998, p. 237).

Affect, Cognition, and CMI

Perhaps the key positive aspect of CMI has been identified as its ability to increase cognitive learning levels over other, more traditional venues of education. In several of these areas, the affective component plays a key and integral part. In a landmark study, Ireland (1999) has demonstrated that the active and deliberate inclusion of an affective component into the curriculum of CMI can increase levels of cognitive learning. This study was a great leap forward since, even though previous studies had shown this relationship between affective components and levels of cognitive learning did exist in traditional classroom situations (e.g., Pettapiece, 1992; Ruck, 1996), no one prior to Ireland had tested to see if the relationship could carry over to CMI--or even if it was even possible to introduce affective components into CMI curriculum.

Another of the key pedagogical benefits that has been identified in CMI is its ability, through technology and software, to foster and enhance the concept of collaborative learning, one of the key underpinnings of constructivist theory (Murphy & Collins, 1997). When defined, collaborative learning almost always draws on both cognitive and affective aspects from which it derives and benefits it delivers. The key benefits claimed for collaborative learning are that it supports active learning and deep processing of information through requiring learners to invest mental effort. Collaborative learning is valued because it can assist in clarifying ideas and concepts through articulation and through discussion. Designing learning around collaborative learning activities is a means to encourage learners to draw upon the rich potential of each other's ideas and perspectives (particularly valued for adult learners). (Steeples & Mayes, 1998, p. 219) Dymock and Hobson (1998) also acknowledged the dual nature of collaborative learning, noting that while CMI is "aimed at the individual learner, there is evidence that social interaction is an important component of effective learning" (p. 157). Cook (1991) stated clearly that collaborative learning strategies can raise students' levels of achievement and attitude. While most studies look at collaborative learning and technologically mediated support groups for their cognitive probity, Dymock and Hobson (1998) sought to understand if and how collaborative learning groups could help "overcome the sense of isolation many distance education students feel" (p. 157), as well as increase the amount of cognitive learning that occurred. The decrease in isolation was found to be the primary benefit of the program, and an increase in student valuing of the collaborative process.

While noting that Internet-based CMI have the potential to be more immediate in some respects than traditional classroom experiences (e.g., providing learners with a sense of personal tutorship), LaRose and Whitten (2000) asserted that

> the present limitations of the Internet medium restrict the teacher immediacy of Web courses and possibly have a negative impact on both affective and cognitive learning. Web courses also appear to be a deficient means to form close relationships between students, or student immediacy. (p.320)

It was their assertion that immediacy factors are incentives to learning, whether traditional or CMI. Norton (2000) also held to the efficacy of student immediacy, and suggested that student mentoring through the means of asynchronous computer-mediated communication, inside a CMI environment, can improve remediation efforts while reducing cost and time commitments of educators.

<u>Maximizing the Utility</u>

Having established the inherent strengths and possibilities of CMI, researchers have also turned their attention to finding ways to capitalize on the CMI process and find the ways and procedures which will maximize its effectiveness. It should be noted, however, that Brogan (2001) reminded educators not to confuse information for instruction, and that all aspects of CMI (e.g., graphics, software, navigational designs, assessments) need to be geared specifically to the overall end of engaging students. Further, Foreman and Widmayer (2000), while reporting success in achieving advanced levels of cognitive learning through CMI, warned other educators to also utilize elements of traditional classroom experiences (e.g., face-to-face interactions and activities) as supplements.

Rankin (1997) found reason to assert that computer mediated learning experiences involving e-mail and World Wide Web interactive activities involving cooperative journal writing can improve both students' writing skills and their propensity to write. In one study involving psychiatric inpatients (Burda, et al., 1995), it was shown that students who received computer therapy laboratory work that mirrored a classroom curriculum on the topics of self awareness, communications, and problem solving achieved significantly higher test scores and had lower rates of absenteeism than students who had the identical classroom curriculum coupled with a computer lab component on attentional and memory training.

The efficacy of CMI seems to cross departmental and specialization boundaries. Sanger, Brecheisen, and Hynek (2001) found conclusive evidence that seeing computer-based (CMI) animations of scientific topics aided in cognitive learning of the topics better than identical, traditional methods which did not use the animations. Similarly, Otero, Johnson, and Goldberg (1999) found that computer technology in science education, especially in collaborative learning situations, can facilitate cognitive learning well beyond that of traditional educational situations. Spencer (2000) demonstrated that, since the processes differ in several key areas, the key relative strengths of each of CMI and traditional educational experiences can produce equal but different cognitive levels, and each can be as satisfying to the students. In some cases, students found the CMI experience more interesting, and perceived a greater degree of higher level learning using CMI.

In a study which demonstrated that certain types of computer programming curriculum could be taught with better cognitive learning by students using a computer-mediated instruction tool as opposed to students who did not have that tool (80% of students using the CMI tool scored in the 90’s on a quiz; 49% of those without the CMI tool scored in the 90’s), McIntyre and Wolff (1998) also discovered that there were affective as well as cognitive issues involved with how students rated the use of the CMI tool. Students with the CMI tool suggested that it was an “easier, fun way of learning complex issues”; that it was “convenient” in relation to time usage and location access; and that it provided opportunities for interactive learning and discussion sessions which were regarded as positive.

Moller (1998) has asserted that, as computer-mediated instruction continues to expand its technological possibilities, just so instructors will need to find and exploit the unique strengths of that medium, rather than merely mimicking traditional face-to-face training or education. In making the case for the creation of “learning communities” for asynchronous distance education, he lists as one of the main reasons for this proposal, in addition to the benefits to cognitive learning, that it will provide such affective components as “enrichment opportunities” (p. 118) and “emotional support for growth or intellectual risk-taking behaviors” (p. 119). By their very nature, these support communities advocated by Moller provide needed “interpersonal encouragement and assistance” (p. 119; Moore & Kearsley, 1996; Gunawardena, 1991).

Support systems do not need necessarily to be limited to humans. Laffey, et al. (1998) described a computer-mediated software application designed to provide learning support for students participating in online project-based learning. This software package was created in an attempt to replicate human interactions and support that would exist in traditional face-to-face learning situations. Among the rationales and learning processes designed into this package are “tools to support self and communal evaluation,” “scaffolding, coaching, and guidance systems fully integrated to assist in the reflection process,” and “tools designed to support the exchange and sharing of ideas and results” (p. 76). The last of these, sharing results, points to the value of social discourse, which can “provide important points of divergence for intellectual growth, challenge students to think more deeply about what they are doing, and spark reflection and restructuring of previously held beliefs in the domain” (p. 79).

Whittington and Sclater (1998) reported the results of a longitudinal study aimed at “exploring, developing, and evaluating techniques for delivering learning materials, supporting collaborative learning, and carrying out assessment over the Internet” (p. 41). Among their findings was that, in addition to the technical (e.g., web site, assessment engine, registration system, technical support) and curricular (e.g., courseware creation and conversion), an affective component which they called “ease of use” was of equal importance in the success of the learning. The premium put on such issues such as graphic design, user interface, and inter-modular navigation systems, which speak to the comfort in and valuing of the system by its users, were factors in leading the authors to conclude that collaboration with users was a prime factor in the success of designing successful online CMI systems.

Selinger (1998) documented successful efforts in creating critical communities "to address the concern that [isolated online CML students] might feel isolated" (p. 23). This electronic support network, which was designed to meet affective needs of individual learners "and to enhance teaching opportunities" (p. 23), comprised discussion forums or conferences, all accomplished through telematics, or online, computer-mediated communications processes. Even with the potentially sterile nature of the text-based medium, Selinger found that (in addition to the purely cognitive purposes served) it provided opportunities for weaker students to get help from stronger ones through e-mail and conferences, increased valuing of others' opinions and knowledge because of the asynchronous time nature of the communications, and in general "it helped them to feel reassured and confident" (p. 29).

Dehler and Porras-Hernandez (1998) documented a study in which a computer-mediated communication (telematics) component was inserted into the curriculum of traditional face-to-face classes. Members of two geographically separated classes participated in structured conferences and debate concerning certain aspects of the course's subject matter. In addition to showing "positive outcomes at the learner, teacher, and classroom levels in terms of learning," the activity was shown to create a more positive "attitude toward technology and attitudes toward other cultures" (p. 54). Maddux (1998) went to great lengths to demonstrate that affective variables as distant from the cognitive content as page design and ease of navigation through the CMI can contribute significantly to the quality and quantity of the learning that is done.

When integrated into a total, third generation distance CMI experience, conferencing has been shown to provide a bridge back from the exclusively individual pursuit it can become to the desirable "social process" of traditional face-to-face learning "in which priority is given to teacher-student and student-student interaction" (Trentin, 1998, pp. 36-37). Such computer-mediated communication can be useful in structured (e.g., through discussion, group work, and network-based learning) as well as unstructured (e.g., through announcements, contacts, questions and answers, and chatting) aspects of the curriculum. It has been shown that these kinds of computer-mediated communications can be of particular value in adult education, "a context where the sharing of personal experience about the subject being studied can play a fundamental role in collective development" (Trentin, 1998, p. 37; Trentin, 1996). This follows and supports Knowles' (1980) concept of the "learning community" for adult education, which has been shown to be effective and valuable in the CMI arena (Wiesenberg & Hutton, 1996).

Feedback is a key affective-centered part of any learning process, particularly inside CMI, since by definition there is no live teacher present to provide information on process or assessment of knowledge gained. Following on studies which demonstrated the unique possibilities for feedback in the CMI medium (e.g, Clariana, 1993; Kulhavy & Wager, 1993) which established the importance of the types of CMI, Rieber (1996) studied the way feedback is provided to students inside a game-based CMI lesson, and found that, while knowledge of the actual subject matter was not affected, students' knowledge of the process of the game/CMI improved markedly and frustration with the CMI process diminished when given an animated (as opposed to text) series of feedback. The import of this is unclear, as it may indicate that the animation feedback was most "alive" and therefore like the accustomed "live" teacher, or that students were more responsive to the special and unique abilities of the CMI as demonstrated in the animations.

Brush (1997) discovered that, when students worked on a math lesson presented via CMI both in cooperative pairs and as individuals, those who worked in pairs reported liking math more ($p<.01$), reported liking the math lesson more ($p<.001$), and reported that the computer helped them with math class work and homework more ($p<.05$) than those who worked individually. Additionally, pre- and post-testing revealed that students working through the CMI in cooperative pairs did significantly better ($p<.05$) than those students who worked individually. Also working with both dyads and individuals involved in learning through CMI, Cavalier & Klein (1998) determined that the addition of instructional objectives at the beginning of the CMI performed significantly better on post-test items than students who received either advance organizers or no orienting activities. In addition, students working in dyads who received instructional objectives exhibited significantly more on-task group behaviors, more helping behaviors, and fewer off-task behaviors than dyads in the other orienting activity conditions.

Conclusions

Several overwhelming and compelling conclusions, which have import for the current research, suggest themselves from the studies detailed above. First, the dramatic and efficacious influence of the affective domain in the educational process (specifically the creation of curriculum) has been demonstrated beyond question, and so therefore the current study's attempt to find an "intersection" between affect and CMI seems wholly justified.

Also, given the fact that the broad majority of research involving the confluence of affect and CMI have been in the areas of (1) gender-related differences in computer use (there is still ambiguity over whether there truly are gender-related differences, and if so, where they emanate from) and (2) computer anxiety and related concepts (there is strong indication that the "approach/avoidance" issues over students' anxiety/self-efficacy impinge on their affective valuation of the CMI and computer experience), there seems strong indication that any study approaching affect and CMI needs to find a way to examine the specific areas of gender and anxiety.

Finally, the accumulated research into the new area of computer-mediated instruction (and design of curriculum for it) all combine to provide a strong justification for further research into areas which will give a stronger, more complete understanding of its efficacy and conceptual composition.

CHAPTER THREE
METHOD

The purpose of this study was to gain the beginnings of an understanding of the inherent linkages that may exist between computer-mediated learning (CML) and affective components of curriculum and instruction. The study queried students who were currently participating in various forms of computer-mediated learning inside and as part of a traditional classroom setting. The purpose of this query was to gather empirical evidence to determine where college-level students' positioning on a "semantic space" (Osgood, et al., 1957) of a computer-mediated learning experience is situated in relation to similar semantic positionings of experiences in (a) traditional classroom learning, (b) non-curricular computer usages, and (c) affective-laden activities both in and out of the classroom. Comparisons of faculty meaning-derived attitudes were also examined. This chapter first describes the type of measuring instrument to be used in the study, the Semantic Differential, and gives details on how the instruments were developed. Next come a description of the survey instrument, the participants, the research design, the study's research questions and hypotheses, and a summary of data analysis.

The Semantic Differential

The principal means for gaining quantitative data on semantic meaning--the measure of meaning--has for the last fifty years been the Semantic Differential (SD), created in the early 1950's by Osgood (Osgood, et al., 1957). As a measurement instrument, the SD has been found to be highly reliable. In early studies, Osgood calculated a test-retest reliability coefficient of .85 (Osgood, et al., 1957; Osgood, 1990); and both Solomon (1954) and Wilson (1954) found test-retest reliabilities significant at the 1 percent level or better.

The SD form gives the participant a set of bipolar adjectives (e.g., good-bad, happy-sad, etc.), each pair arranged with a seven-space continuum provided between them, in this manner:

good ___:___:___:___:___:___:___ bad

The practice of using seven blanks or spaces in the continuum was found in early research to be "an optimum degree of discrimination for rapid yet reasonably reliable judging" (Osgood, et. al, 1975).

The participant is given one or more noun Concepts (e.g., "Republicans," "birds," "China," "love"), and then is asked to find the position between each of the bipolar adjectives that he or she believes fits the Concept(s), similar to this:

Concept: LOVE   good _X_:___:___:___:___:___:___ bad

Thus, the participant defines something similar to a Euclidean position for a Concept on a straight-line semantic (meaning-derived) continuum between the adjectival opposites, scale by scale, Concept by Concept.

The guidelines that Osgood (Osgood, et al., 1957; Snider & Osgood, 1969) established that the researcher must employ in selecting scales (adjectival pairs) for use in an SD inventory specify that a small number (10 to 12) of the bipolar pairs be chosen, and that the choice of those scales be made using three specified criteria. The first criterion is that approximately an equal number of the scales come from the three common over-arching factors found in myriad early studies--Evaluative, Potency, and Activity. These three factor-analytically derived groupings of concepts were found to be virtually universal in studies, regardless of which sets of bipolar adjectives or which noun-concepts were used (Osgood, et al., 1957; Snider & Osgood, 1969; Solomon, 1954; Tucker, 1955). These factors appear to be so stable and pervasive that

> in every instance in which a widely varied sample of concepts has been used, or the concept variable eliminated as in forced-choice among the scales, the same three factors have emerged in roughly the same order of magnitude. A pervasive *evaluative factor* in human judgment regularly appears first and accounts for approximately half to three-quarters of the extractable variance. Thus the *attitudinal* variable in human thinking, based as it is on the bedrock of rewards and punishments both achieved and anticipated, appears to be primary – when asked if she'd like to see the *Dinosaur* in the museum, the young lady from Brooklyn first wanted to know, "Is it good or is it bad?" The second dimension of the semantic space to appear is usually the *potency factor*, and this typically accounts for approximately half as much variance as the first factor – this is concerned with power and the things associated with it, size, weight, toughness, and the life. The third dimension, usually about equal to or a little smaller in magnitude than the second, is the *activity factor* – concerned with quickness, excitement, warmth, agitation and the like. (Osgood, et al., 1957, pp. 72-73).

Osgood explained the ubiquity of the Evaluative (E), Potency (P), and Activity (A) factors in human attitudinal or affective systems by suggesting that

> man really is, contrary to the view of Chomsky and the rationalists, a kind of animal. What is most important to man now about the signs of things, as it was in the days of Neanderthal Man, are +E (Do they signify things *good* or *bad* for me?), +P (Are the things signified *strong* or *weak* with respect to me?), and +A (Do they refer to things that are *active* or *passive* – things that I must fight or flee, or things I can simply avoid or ignore?) These "gut" reactions to the signs of things are crucial for individual survival. (Tzeng, 1990, p. 16)

The second criterion for SD inventory creation is that the scales have a relevance (semantic stability) to the concepts being described; that is, semantically and logically, there must be a meaning-derivable link between the concept and the bipolar set of adjectives. Because the seven blanks or spaces imply adverbial modifiers ("extremely," "quite," and "slightly"; see above) to the bipolar adjectives, and because the concept being rated is a noun, Osgood asserted that marking one of the spaces creates a semantic "sentence," of the generic form: Noun be modified adjective – "Babies are quite small," "The color red is extremely active," "Tornadoes are extremely unfair" (Osgood, et. al, 1975, p. 41). Therefore, the bipolar adjectives chosen need to have some measure of meaning-derived relevance (semantic stability) vis-à-vis the concept. However, as SD researchers have pointed out, there can be merit to forcing participants "to extend themselves to think in metaphors and difficult-to-explain associations" (Brown, 1969, p.85). Following Osgood's "sentence" analogy, participants

> are encouraged to create "sentences" that – literally speaking, in their own ordinary languages – would be semantically anomalous and therefore unlikely to actually appear in any corpus. Literally speaking, a tornado cannot be either *fair* or *unfair* (only humans can have these attributes), and subjects ought to judge the item as irrelevant by checking the zero [middle] position on the scale. The fact of the matter is that nearly all native English-speakers, *working under SD conditions*, judge tornado to be *extremely unfair*. This characteristic of the SD technique--the way it forces the use of metaphors--turns out to be highly significant both for its power to reveal affective universals and for its limitation in revealing other types of semantic features. (Osgood, et al., 1975, p. 42)

Brown's reminder of the ability of the human mind to stretch itself beyond the bounds usually set for connotative semantics ("Boulder, for example, would probably be scaled as more loud than soft" (p.87)) is mirrored by Weinreich (1969). Noting the "surprisingly reliable" (p.117) ability of the Semantic Differential to compare the generalized semantic profiles of differing concepts, Weinreich adds

> This is the case not only when concepts are rated on "appropriate" scales, such as feather (light-heavy), lady (smooth-rough), etc., but also when seemingly "inappropriate" scales are added: when 112 subjects were retested as to concepts judged on a set of scales of varying "appropriateness," 66% of the answers deviated by less than half a place, and 87% of the answers deviated by less than a full place. (p.117)

The third criterion for SD inventory creation is that sometimes scales not in one of the established factors are deemed relevant for a given study, and that they are perfectly acceptable to be used. According to Osgood, "Often scales of unknown factorial composition are highly relevant to a particular problem, e.g., the scale *liberal-conservative* in a study of political concepts. Such scales may, of course, be used" as long as the inventory includes "standard reference scales in the total set" (Osgood, et al., 1957, p. 79).

Osgood offers little guidance on the selection of the concepts used in studies other than to suggest that "it is the nature of the problem that chiefly defines the class and form of the concept to be selected" and to suggest that the investigator use "good judgment" to make sure that the concepts will bring forth "considerable individual differences" from the participants, that they have single, unitary meaning for individuals, and that they be familiar to the participants of the study (Osgood, et al., 1959, pp.77-78).

The Survey Instrument

Two survey instruments were devised for use by student participants and by faculty participants. (See Appendices A and B.) With two exceptions, the two inventories were identical. First, the student inventory asks for specific demographic information, including gender, class status (i.e., freshman, sophomore, junior, senior), course and section number, and the final grade the student expects to receive in the course; the faculty inventory asks for none of these data. Second, one of the 12 Concepts needed to be changed to reflect the "mirror-image" relationship it refers to. Students received a Concept labeled "Conversing with the Instructor of this class" whereas for that Concept, faculty were given "Conversing with students outside of class." After instructions are given on how to fill out a Semantic Differential form (adapted from Osgood, et al. (1957, pp.82-83)), the instruments present 12 Concepts, each with 15 bipolar adjectival scales, to which the participants responded by placing an "X" on one of seven spaces provided between each two adjectives.

The instrument was carefully created so as to follow Osgood's guidelines (Osgood, et al., 1957; Snider & Osgood, 1969) faithfully and completely, especially the three criteria required for selection of adjectival scales (see above). Regarding criterion one, factorial composition, Osgood stipulated that if there is an imbalance of numbers of scales from the three factors, Evaluative should have the larger amount. The number of scales chosen for the inventory used in this study are distributed by factor as follows: Evaluative 5, Potency 4, and Activity 3. Table 1 shows the factor loadings (in the original factorial studies) of the scales chosen for this study.

Table 1
Factor Loading of Scales Used in Survey Instrument
From Original Factor Analytic Studies
(Osgood, et al., 1957, pp. 33-39; Snider & Osgood, 1969, pp. 44-49)

Adjective Pairs	Loadings		
	I Evaluative	II Potency	III Activity
1. good-bad	**.88**	.05	-.09
2. honest-dishonest	**.85**	.07	-.02
3. fair-unfair	**.83**	.08	-.07
4. pleasant-unpleasant	**.82**	-.05	.28
5. valuable-worthless	**.79**	.04	.13
6. strong-weak	.19	**.62**	.20
7. large-small	.06	**.62**	.34
8. heavy-light	-.36	**.62**	-.11
9. hard-soft	-.48	**.55**	.16
10. fast-slow	.01	.00	**.70**
11. active-passive	.14	.04	**.59**
12. sharp-dull	.23	.07	**.52**

The second criterion for scale selection, semantic stability, mandates that scales chosen be appropriate for the Concepts that are being studied, while allowing for some scales which might require a more metaphorical approach to the semantic space by the participants. Care was taken to choose scales which would elicit stable, informative, and appropriate semantic responses from the participants in the subject matters of affective and cognitive aspects of college course work and life, and to allow for meaningful comparisons of participant responses to the various Concepts.

Following Osgood's assertion that scales of unknown factorial composition are sometimes relevant to a study (criterion three), two scales were added to represent the major areas of research into the affective component of computer mediated learning that are represented in the literature: computer anxiety (scale: anxious-confident) and gender studies (scale: feminine-masculine). Based on consultation with and recommendation from a subject matter expert in the area of measurement and the Semantic Differential, a third additional scale from outside the factorial composition was added (scale: simple-complex).

A pilot study was run specifically to elicit participant feedback as to the efficacy and appropriateness of all of the chosen scales. First year graduate students (n=54) were given the survey instrument, requested to complete it, and then asked for their written and oral feedback on the scales themselves. While those comments led to minor adjustments and clarifications in the directions on how to fill out the survey, there were no indications that the participants found the Concepts unclear or the scales inappropriate.

The 12 Concepts that participants rated inside the semantic space of the 15 scales (see Table 1 for 15 scales) were chosen to represent the four Issues associated with the problem to be studied. Choice of the specific 12 Concepts used was done to conform to the operationalizings and Kaplan’s Taxonomy of Affective Behaviors (TAB) associated with Krathwohl’s Affective hierarchy (Kaplan, 1978; Kaplan, 1986; Krathwohl, et al., 1964), as well as the result of consultations with subject matter expert. The four Issues, under which the 12 Concepts are found, include computer-mediated learning, traditional classroom learning experiences, activities highly associated with affective connotations, and experiences of computer users. Table 2 shows the association between these four Issues and the 12 Concepts used in the Semantic Differential inventory.

Table 2
Issues and the Semantic Differential Concepts Used to Represent Them

Issues	**Semantic Differential Concepts**
A. Computer-Mediated Learning	1. The computer/lab component of this course
B. Traditional classroom learning experiences	2. In-class small-group discussions 3. The lecture/classroom component of this course 4. Oral presentations of my own work in a course 5. Writing term papers for a course 6. Taking an examination in a course
C. Activities highly associated with affective connotations	7. Socializing with friends outside of class 8. Conversing with the instructor of this class
D. Experiences of computer users	9. Myself as a user of computers 10. E-mail as a communications tool 11. The Internet as an entertainment source 12. The Internet as a source of information

Each of the 12 Concepts was rated using the identical 15 scales, though the order of the 15 scales was randomly changed for each Concept. Appendix C gives the Quick Basic v4.5 code written and used to produce 12 random orders (one for each of the 12 Concepts) of the 15 scales.

The polarity of the block of scales (good-bad as opposed to bad-good) was randomly shifted back and forth in each Concept so that "good" scalar adjectives (e.g., good, active, pleasant) did not always appear on the left or right of the set of scales.

Description of the Participants and Research Design

The participants were undergraduate students at an American midwestern university of business and management who were enrolled in courses which contained either a computer lab component or some other type of computer-mediated instruction ancillary to the traditional classroom lecture/seminar content. Students (n=228) and faculty (n=9) from a total of 18 sections participated in the study by filling out inventories. The students came from a wide ranging geographic area (including several foreign countries), were approximately the same age (18 to 21), were of a wide cross-section of academic achievement (when asked to give their expected grade, on a 4.0 scale, in the course in which the inventory was given, participants self-reported a median=3.3 and mean=3.17 with standard deviation=.745), and were of a fairly wide range of socio-economic status.

Student participation in the study was optional. The survey was completed anonymously, no course credit was associated with the inventory, and faculty administered the survey under examination conditions.

Research Questions and Hypotheses

The research questions for this study are as follows:

1. How do students' meaning-derived attitudes toward computer mediated learning relate to their meaning-derived attitudes towards the other three Issues: affective activities, traditional (non-computer) classroom learning activities, and non-classroom uses of computers?
2. Does gender difference affect meaning-derived attitudes towards any of the four Issues?
3. Does the issues of computer-mediated instruction differ from the other eleven concepts in relation to the scale of anxious-confident?
4. Do faculty's meaning-derived attitudes differ from those of their students in any of the four Issues?

Following results reported above from previous studies and theoretical writings in the areas of CMI and affect in computer use and curriculum, the following hypotheses are put forward, based on the above research questions:

H1: Participants' meaning-derived attitudes toward computer mediated learning most closely relates to their meaning-derived attitudes toward traditional (non-computer) classroom learning activities; next most closely to attitudes toward non-classroom uses of computers; and least closely to attitudes toward affective activities.

H2A: There is a statistical difference based on gender in participants' meaning-derived relative attitudes toward computer mediated learning, non-classroom uses of computers, traditional (non-computer) classroom learning activities, and affective activities.

H2B: There is no statistical difference based on gender in participants' meaning-derived attitudes concerning the 12 Concepts on either the anxiety or complexity scales. There are, however, gender-based differences on the gender scale.

H3A: There is no statistically significant correlation between participants' meaning-derived attitudes reported in the "anxious-confident" scale of the computer mediated learning Concept and the attitudes reported in the "anxious-confident" scale of the "non-computer" Concepts—the seven Concepts in the traditional (non-computer) classroom learning activities grouping and in the affective activities grouping.

H3B: There is a statistically significant correlation between participants' meaning-derived attitudes reported in the "anxious-confident" scale of the computer mediated learning Concept and the attitudes reported in the "anxious-confident" scale of the four Concepts in the c non-classroom uses of computers grouping.

H4A: There is no statistical difference between students' and faculty's meaning-derived relative attitudes in computer mediated learning, traditional (non-computer) classroom learning activities, attitudes toward non-classroom uses of computers, or affective activities.

H4B: There is no statistically significant difference between students and faculty in their meaning-derived attitudes concerning the 12 Concepts on the anxiety, gender, or complexity scales.

Data Analysis

Twelve of the 15 bipolar scales used in the semantic differential (SD) of the current study were drawn from previous seminal studies (Osgood, et al., 1957; Snider & Osgood, 1969), which studies demonstrated the almost universal existence of three over-arching semantic factors: Evaluative, Potency, and Activity (E-P-A). Data obtained from the administration of the instrument in the current study were factor analyzed to examine the factor structure obtained and to compare it to that of the "expected" E-P-A factors. Trial factorizations have been done (1) using just the 12 original bipolar scales; (2) with all 15 bipolar scales; and (3) once again with the 15, forcing them into a total of three factors.

Operationalizings for Current Study. The research questions and hypotheses posited for this study involve comparisons of participants' meaning-derived (semantic) "positionings" of four over-arching Issues: computer-mediated learning; traditional classroom learning experiences; activities highly associated with affective connotations; and experiences of computer users. Each of these Issues is operationalized for this study by one or more Concepts which illustrate that Issue. (See Table 2.) Participants' meaning-derived "position" on each of these Concepts is operationalized by her/his summative responses about that Concept on 15 semantic differential bipolar scales. Participants' meaning-derived "position" on any one of the over-arching Issues is operationalized as the mean of responses to the various Concepts that make up that Issue.

Meaning-derived proximity or closeness in conception between two concepts is operationalized as the calculation of the Osgood D (Euclidean distance) value between those concepts (see explanation below). The lower the D value, the more closely related (semantically) the two concepts are perceived. Calculation of the Osgood D value is done (1) by using all of the 15 bipolar scales, and (2) by collapsing the scales into the Osgood SD factors (Evaluative, Potency, and Activity), plus the three new scales added for this study.

Semantic Differentials and the Osgood D. Much of the analysis demanded by the stated hypotheses involve comparisons of SD ratings of several concepts against each other. Because the meaning-derived "positioning" for a given concept is based on the summative responses to all of 15 bipolar scales, the normal reponse for statistical analysis would most likely be Pearson Product Moment Correlation. However, Osgood (Osgood, et al., 1957, p. 90) demonstrated clearly that in the case of the semantic differential, use of correlation coefficient could yield misleading results. He gave an example of a situation in which three concepts, judged using the same series of five bipolar adjectives, resulted in ratings shown in Table 3.

Table 3
Semantic Positionings for Three Concepts

Concepts →	1	2	3
scale 1:	1	2	4
scale 2:	4	5	7
scale 3:	3	4	6
scale 4:	2	3	5
scale 5:	4	5	7

A correlation calculation of these positionings would clearly yield a "perfect" correlation for all pairings, as each rises and falls identically to the others on successive scales, as shown in Table 4.

Table 4
Pearson Correlations of Semantic Positionings

Concepts	1	2	3
1	1.0		
2	1.0	1.0	
3	1.0	1.0	1.0

However, Osgood pointed out that this piece of information might make one think that the three concepts were viewed or "positioned" identically, when clearly they did not. Concept (1) was clearly to the "left" (however that was defined on the scales) of Concept (3); there was a semantic difference or "distance" in the positionings. Osgood's solution was adoption of a simple Euclidean distance formula, which is equal to the square root of the sum of the distances squared. Thus, the three Concepts referred to above would yield Osgood D values representative of their meaning-derived "distances" from one another, as shown in Table 5.

Table 5
Osgood D values for Semantic Positionings

Concepts	1	2	3
1	0		
2	2.236	0	
3	6.708	4.472	0

In the current study, there are 12 total Concepts that create the four Issues. Therefore, computation of a 12x12 Concept chart of Osgood's D will give a mathematical summary of the relative semantic, meaning-derived positionings of the Concepts (and, hence, Issues). In the 3-Concept example above, there are only three possible pairings of different Concepts (i.e., 1 to 2, 1 to 3, and 2 to 3), and gaining an understanding of the relative semantic "distances" between them is fairly easy to understand merely from studying the Osgood D value matrix. However, in the current study, with 12 total Concepts, there are 66 pairings in the 12x12 matrix, and in such a large matrix, it is virtually impossible to gain a true picture of the myriad "distance" relationships among the various Concepts. Submitting the Osgood D value matrix to multidimensional scaling analysis (see explanation below) provides the tool for that understanding.

Conversion of the raw data back to correct order of Concepts and a standard polarity among the scales, and the calculation of the Osgood D, are complicated issues. No standard statistical package today is equipped to calculate the Osgood D in the myriad forms needed for this study, much less handle the raw data conversion, so the author wrote original software in Quick Basic v4.5 to handle all of these tasks. (Complete source code for the program is given in Appendix E.) The need for accuracy in the conversion and calculation phases was, of course, of top concern. To test the output of the software, dummy data were created in the various forms which the program might encounter. The dummy data was written in such a way that the conversion of polarities and orders and the calculation of Osgood D’s was easy to do by hand.

Comparison was made of these hand calculations with the output of the software, and complete accuracy was found. (Appendix F shows the results of these tests.)

Finally, for some of the hypotheses, which ask for a comparison of means between how two different groups (e.g., female/male, student/faculty) responded to individual bipolar scales (as opposed to summative scales that make up an entire Concept), one-way analysis of variance (ANOVA) and Pearson Product Moment Correlation were used, according to methods delineated by Osgood (Osgood, et al., 1957; Snider & Osgood, 1969).

Multidimensional Scaling. Analysis of the myriad proximity measures (the Osgood D values) is accomplished through use of Multidimensional Scaling (MDS), which translates the semantic distances obtained from the D calculations into two-dimensional Euclidean representations. In those representations,

Multidimensional scaling (MDS) is a data analysis technique which takes as input a series of proximities-- which may be defined as numeric values "which indicate how similar or how different two objects are, or are perceived to be, or any measure of this kind" (Kruskal & Wish, 1978, p. 7) --and which gives as output a geometric configuration of points in spatial relation, reflecting the structure found in the data. "By reflecting the data structure we mean that the larger the dissimilarity (or the smaller the similarity) between the two objects, as shown by their proximity value, the further apart they should be in the spatial map" (Kruskal & Wish, 1978, p. 7). Stalans' (1995, p. 140) succinct definition was that "MDS mathematically transforms the perceived relatedness among items into a visual representation of distance. That is, distance (the space between two items) in a spatial plot is an analogy for the perceived relatedness among the items." Therefore, the more closely related two items are perceived to be, the closer the physical (Euclidean) distance represented in the MDS mapping; the less closely related they are, the farther apart they will appear on the mapping. MDS mappings may be in one, two, or three dimensions, and the calculations may extend to more, though representing them in any meaningful graphical way is impossible beyond three dimensions.

By extension, then, the clustering of Concepts on an MDS mapping indicates a similarity (based on whatever scale is being measured) among those Concepts, as perceived by the source(s) of the proximities (Guttman, 1966; Wish & Carroll, 1974). In this study, because the Osgood D is, by its very definition, a Euclidean distance measuring device (Osgood, et al., 1957), calculation of the D between all combinations of pairs of Concepts yield appropriate data for MDS mapping. The relative placement of the Concepts on the MDS mapping (e.g., which Concepts cluster together, which are farthest apart) provides an easily accessible graphical rendering of how participants' meaning-derived evaluations of the Issues and Concepts of the study relate to one another.

The more items or Concepts that an MDS scaling must map means the less likely that a one-, two-, or even three-dimensional can represent all of the myriad proximities completely. Therefore, a measure of "goodness of fit" for each MDS mapping is calculated called the stress measurement (Kruskal, 1964b). Kruskal's stress is a metric stated in a number from zero (indicating a perfect fit) to one (indicating worst possible fit) (Stalans, 1995). Kruskal provided a guide to rating how completely an MDS scaling maps the distance relationships of all of the Concepts within it (Golledge & Rushton, 1972, p. 12), as shown in Table 6.

Table 6
Kruskal's Evaluation of MDS Stress Values

Stress	Goodness-of-Fit
.40	poor
.20	fair
.10	good
.05	excellent
.00	perfect

Kruskal's stress index has also been referred to as "badness-of-fit," because the larger the number in the stress measurement, the less adequate the mapping may be considered (Kruskal & Wish, 1978).

Summary

Using Osgood's Semantic Differential to measure the confluence of attitudes and "positionings" of the four Issues was seen as a highly reliable, non-reductionist, yet theoretically and procedurally standardized approach. Great care was given to create an SD inventory within the guidelines set down from the earliest conceptualizations of the Semantic Differential form. The final inventory, which used as its core 12 bipolar adjectival scales from seminal SD studies, also included scales relating to gender, anxiety, and complexity. The 15 bipolar scales were used for participants to rate the 12 noun Concepts, drawn to represent the four Issues of the study (computer-mediated learning, traditional classroom experiences, activities highly associated with affect, and non-classroom computer uses). Methods were created to convert data and calculate Osgood's D values, in order that it might be used in Multidimensional Scaling, ANOVA, and Pearson Product Moment Correlation analyses.

CHAPTER FOUR
RESULTS

This chapter first describes the preliminary calculations and analysis that were done, including determination of reliability of the survey instrument used in this study, statistical analysis leading to a decision on how to handle missing data in the current study, and factor analysis of obtained scalar values (and comparison of these to previous SD factor analytic studies and preconceived factor composition of the current instrument). Following this come results of statistical and graphical analyses done to test hypotheses listed in the previous chapter.

Preliminary Considerations

Reliability. The survey instrument used in this study (see Appendices A and B) was tested for reliability, yielding an alpha of .9555. Split-half reliability testing produced alphas of .9336 and .9251. (See Appendix D for complete reliability calculation results.)

Missing data. One large problem which had to be solved before analysis of collected data from this study could begin was the question to how to deal with survey forms returned with missing data. Osgood's set of instructions on how to fill out the SD form (adapted for use in the current study) specifically requests participants to answer every question (Osgood, et al., 1957). The practical reason for this is that the formula for the calculation of the Osgood D value is predicated on there being no missing values. When the summation is done on the formula of all of the squared differences, if one of those differences is missing as a result of missing data, the D value is artificially (and incorrectly) lowered, suggesting that there is a smaller Euclidean distance between the two Concepts than there actually is.

Osgood and other authors on the SD have all been overtly silent regarding the way to handle missing data in SD data collection, although indirectly Osgood seemed to hint at what the solution might be. In his directions on filling out an SD inventory, he stated that participants should check the middle value between the two bipolar adjectives if they "consider the concept to be *neutral* on the scale, both sides of the scale *equally associated* with the concept, or if the scale is *completely irrelevant*, unrelated to the concept" (Osgood, et al., 1957, p. 83). These criteria could be construed to be equivalent to many or most of the reasons why participants would leave a scale blank; ergo, following this reasoning, changing blank scales to ones with the middle space checked might be seen to retain the spirit and letter of the theory behind the SD.

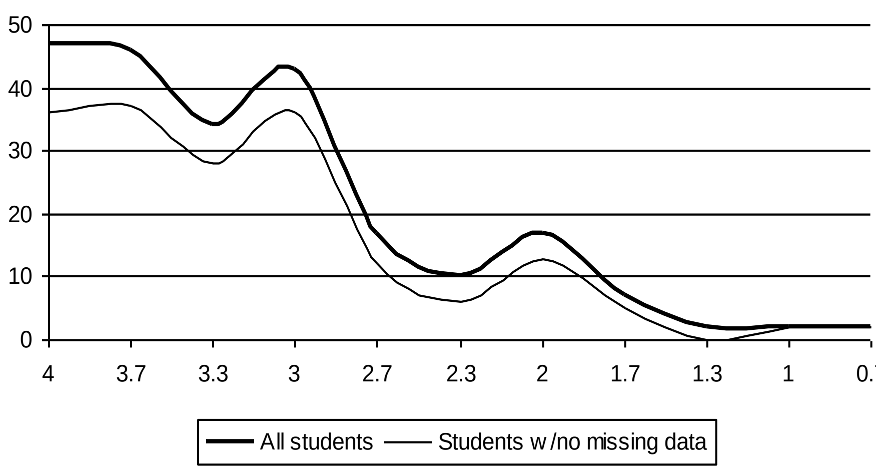
For the current study, after consultation with measurement and statistical analysis subject matter expert, it was decided that, if at all possible, it would be best to use data that had *not* been altered from the original participants' intentions. Therefore, it was decided to compare the Osgood D values of those records with *no* missing data (n=186) with the D values of *all* data (n=237), amended to change missing scales to a checked middle space (a 4 value in a 1-to-7 range), and if the two sets of D values were not shown to be significantly different, then the small, in tact data set would be used. A total of 66 D values (12 Concepts compared to each other; 1 to 2, 1 to 3, … 2 to 3, 2 to 4, … 11 to 12) were calculated for each record on both sets of data, and these D values were submitted to a series of 66 Mann-Whitney/Wilcoxon tests. Final results showed no statistically significant difference between any of the 66 calculated D values (see Appendix G for complete results of these tests), and so it was decided to use only the records in which there were no missing data.

How representative is the smaller (n=186) group of participants whose surveys had no missing data) to the larger, complete group of participants? The major answer comes in there being no significant difference in any of their 66 D values (see above), but the few demographic pieces of data collected can also show the similarity that exists.

Table 7
Demographic Comparisons Between All Student Participants and Student Participants Who Left No Missing Data in Survey Instrument

Demographics for:	All student participants	Student participants who left ***no*** missing data
Gender	100 (45.7%) female 119 (54.3%) male	80 (47.1%) female 90 (52.9%) male
Class year	21 (9.3%) freshmen 35 (15.5%) sophomores 69 (30.5%) juniors 101 (44.7%) seniors	15 (8.5%) freshmen 27 (15.3%) sophomores 55 (31.3%) juniors 79 (44.9%) seniors
Grade expected in course	3.17 mean 3.30 median	3.10 mean 3.30 median

Figure 1
Comparison of Expected Grade in Course Between All Student Participants and Student Participants Who Left No Missing Data in Survey Instrument



As shown in Table 7, the demographics of the group of student participants who left no missing data is very close to that of all student participants. The mean of expected grade dropped .07, but the median stayed exactly the same, and distribution through class year remained relatively static. While it is true that 20% of the female pool of student participants left missing data as opposed to 24.4% of the male pool, what remains in the new group is quite close in terms of percentage ratio.

Factor analysis. While it is true that discovering the factor distribution of the 15 bipolar adjectives used in the current survey instrument is *not* part of the research questions and hypotheses put forth, it is perhaps of more than passing interest to see (as previous studies have done) (1) whether the Evaluative-Potency-Activity factors were replicated in this study and (2) what effect, if any, the addition of the three additional scales in this study – confident/anxious, feminine/masculine, and simple/complex – had on the E-P-A factoring. Three factor analysis studies were done, using all of the twelve- or fifteen-scale groupings for all 12 Concepts by all 237 participants (n=2844). In each, the method of analysis was Principal Component, with Varimax rotation. (See full results in Appendix H.)

In the first study, only the 12 bipolar scales that had been drawn from E-P-A factorings from previous studies were used. The analysis derived only two factors (rather than the expected three) with Eigenvalues greater than one, cumulatively accounting for 54.6% of the total variance. Table 4 shows the factor loadings, indicating that a new large Factor 1 (alone accounting for 42.3% of the total variance) combines the scales from both the previous Evaluative and Activity factors, as well as the "strong/weak" scale, previously in the Potency factor. Factor 2 comprises the remaining three scales of the Potency factor. The fourth column in Table 8 indicates which of the previous factors each bipolar scale belonged to.

Table 8
Factors Obtained from 12 Bipolar Scales
Drawn from E-P-A Factors in Previous Studies

	1	2	E/P/A
good-bad	**0.8161**	-0.0118	E
pleasant-unpleasant	**0.7877**	-0.1458	E
fair-unfair	**0.7733**	0.0389	E
strong-weak	**0.7610**	0.1595	P
sharp-dull	**0.7277**	0.1850	A
valuable-worthless	**0.7274**	0.0863	E
active-passive	**0.6697**	0.2277	A
honest-dishonest	**0.6301**	0.0967	E
fast-slow	**0.6240**	0.0433	A
heavy-light	0.1162	**0.7879**	P
hard-soft	-0.1337	**0.7546**	P
large-small	0.3976	**0.5149**	P

In the second study, the three additional bipolar scales used in this study were added in with the 12 bipolar scales that had been drawn from E-P-A factorings from previous studies. Again, the analysis derived only two factors (rather than the expected three) with Eigenvalues greater than one, cumulatively accounting for 48.6% of the total variance. (A third factor was indicated, with an Eigenvalue of .978. That will be considered below.) Table 9 shows the factor loadings, indicating that the same new large Factor 1 (this time accounting for 36.5% of the total variance) emerges as the strongest factor. Once again, scales from both the previous Evaluative and Activity factors plus the "strong/weak" scale from the previous Potency factor are combined. In addition, the "confident/anxious" factor is subsumed into the new Factor 1. Factor 2 comprises the remaining three scales of the Potency factor, plus two of the new bipolar scales, “simple/complex” and “feminine/masculine.” The fourth column in Table 5 indicates which of the previous factors each bipolar scale belonged to.

Table 9
Factors Obtained from 15 Bipolar Scales
Drawn from E-P-A Factors in Previous Studies and New to Current Study

	1	2	E/P/A
good-bad	**0.8043**	-0.0246	E
pleasant-unpleasant	**0.7780**	-0.1664	E
fair-unfair	**0.7662**	0.0328	E
strong-weak	**0.7654**	0.1367	P
sharp-dull	**0.7299**	0.1643	A
valuable-worthless	**0.7170**	0.0964	E
active-passive	**0.6790**	0.1769	A
honest-dishonest	**0.6332**	0.0881	E
confident-anxious	**0.6309**	-0.0548	(new)
fast-slow	**0.6214**	0.0282	A
hard-soft	-0.1059	**0.7359**	P
heavy-light	0.1561	**0.7036**	P
simple-complex	0.2773	**-0.6155**	(new)
large-small	0.4224	**0.4772**	P
feminine-masculine	-0.1248	**-0.3098**	(new)

Table 10
Factors Obtained from All 15 Bipolar Scales
Forced to Show 3 Factors

	1	2	3	E/P/A
good-bad	**0.7935**	-0.0860	0.1252	E
strong-weak	**0.7731**	0.1010	0.0243	P
fair-unfair	**0.7605**	-0.0215	0.1047	E
pleasant-unpleasant	**0.7583**	-0.2299	0.1274	E
sharp-dull	**0.7327**	0.1154	0.0985	A
valuable-worthless	**0.7296**	0.0794	-0.0607	E
active-passive	**0.6833**	0.1325	0.0885	A
honest-dishonest	**0.6448**	0.0740	-0.0573	E
confident-anxious	**0.6300**	-0.0809	-0.0128	(new)
fast-slow	**0.6271**	0.0081	-0.0315	A
hard-soft	-0.0825	**0.7060**	0.2391	P
heavy-light	0.1916	**0.6935**	0.0843	P
simple-complex	0.2226	**-0.6820**	0.2049	(new)
large-small	0.4499	**0.4632**	0.0247	P
feminine-masculine	-0.0617	-0.1180	**-0.9368**	(new)

In the third study, all 15 bipolar scales used in this study were once again factor analyzed, this time with instructions to force a third factor. This was done because a third factor was shown with an Eigenvalue of .978, which was considered close enough to the 1 threshold that the result bore examination. Table 6 shows the factor loadings, indicating that the 12 previous E-P-A bipolar scales loaded into the identical factors as in the two studies above, and that once again “confident/anxious” loaded in the new Factor 1 (Evaluative-Activity) and “simple/complex” loaded in the new Factor 2 (Potency). The new Factor 3 comprised in its entirety the one new bipolar scale “feminine/masculine,” with a loading of –0.9368. Because of the negative valence of the loading number, the third Factor should probably carry the name “Masculinity.” The fourth column in Table 10 indicates which of the previous factors each bipolar scale belonged to.

Results for Hypothesis 1

Hypothesis 1 posited that participants’ meaning-derived conceptions toward computer-mediated instruction (CMI) would most closely resemble their meaning-derived conceptions of traditional (non-computer) classroom learning activities; next most closely their conceptions toward non-classroom uses of computers; and least closely to attitudes toward affective activities.

For each participant, Osgood D values were calculated using all four possible combinations of 12 Concepts (which produced 66 D values) or four Issues (which produced six D values) measured by 15 bipolar scales or six factors. (The factors were obtained by finding the means of component scales for the Evaluative, Potency, and Activity factors. The other three factors were merely the single-scale reading of the gender, anxiety, and complexity scales.) Each of these four groups of measurements was analyzed using Multidimensional Scaling (MDS), which produced “best fit” of Euclidean distance mappings of the D values–-two-dimensional mappings for the twelve-Concept calculations (Figures 2 and 3 in Appendices I1 and I2) and one-dimensional mappings for the four-Issue calculations (Figures 4 and 5 in Appendices I3 and I4).

Several conclusions suggest themselves in the MDS mappings. In the first of them, as shown in Figure 2 (Appendix I1), the following are clear:

- The semantic positioning of the Concept “Computer-Mediated Instruction” (CMI) lies in the upper right quadrant, clustered with two Concepts from the Issue ‘Traditional Classroom Learning Experience’–-“taking an examination in a course” and “writing term papers for a course.”
- The remainder of the Concepts subsumed under the Issue ‘Traditional Classroom Learning Experience’ cluster in the lower right quadrant–-“oral presentations of my own work in a course,” “the lecture/classroom component of this course,” and “in-class small-group discussions.”
- Diagonally opposite the “Computer-Mediated Instruction” (CMI) Concept (and therefore at the greatest Euclidean semantic “distance” from it) are the Concepts that make up the ‘Activities Highly Associated with Affective Connotations’ Issue--“conversing with the instructor of this class” and “socializing with friends outside of class.”
- Clustered in the upper left quadrant lie three of the four Concepts that make up the ‘Experiences of Computer Users’ Issue—“myself as a user of computers,” “the Internet as an entertainment source,” “and the Internet as a source of information.” The fourth Computer Usage Concept–-“e-mail as a communications tool”-–lies between the “computer” Issue and the “affective” Issue.

These clusterings demonstrate the relative semantic (i.e., meaning-derived) distance the participants found between the 12 Concepts. As predicted in the first hypothesis, participants' semantic positioning for computer-mediated instruction (CMI) most closely resembles their positioning for items in the 'Traditional Classroom Learning Experiences' Issue, though only with those which have to do with *written* communications in the classroom ("writing an exam" and "writing a term paper"). The remaining "classroom" Concepts (i.e., those having to do with *oral* communication–-"oral reports," "class lectures," and "class discussions") are clustered farther away, near the affective Concepts ("talking with the teacher," and "socializing with friends"). Again, as predicted in the first hypothesis, CMI is next most closely positioned near the Concepts that make up the Issue 'Non-Classroom Experiences of Computer Users,' and furthest away from the Concepts that define the "Affective" Issue.

Much of the interpretation of the ordering and scaling found in Figure 2 can be verified by looking at scalings using different configurations of the data. The MDS graph produced by using the 12 Concepts against the 6 factors (Figure 3, Appendix I2) is substantially identical to that produced by the full 15 bipolar scales. The groupings forming the 4 quadrants are, in fact, the same, identifying and verifying them as legitimate semantic mappings. When the 12 individual Concepts are reduced to the four overall Issues ('Computer-Mediated Instruction,' 'Traditional Classroom Learning,' 'Non-Classroom Computer Uses,' and 'Affective Activities'), the linear (and hence Euclidean distance) relationships displayed in the previous two MDS graphs are brought into sharp relief. (See Figures 4 and 5, Appendices I3 and I4.) 'Computer-Mediated Instruction' sits alone and far apart from the other three Concepts. The other three Issues appear in the same order hypothesized: nearest is 'Traditional Classroom Learning,' next 'Non-Classroom Computer Uses,' and furthest 'Affective Activities.'

Therefore, this study finds evidence to accept Hypothesis 1 which stated that the "linear" ordering (ergo, meaning-derived semantic spacing) of the four Concepts would be computer-mediated instruction, non-computer (traditional) classroom learning experiences, non-classroom uses of computers, and affective activities.

Results for Hypotheses 2A and 2B

Hypothesis 2A and 2B posited that there are differences based on gender in students' meaning-derived attitudes toward computer mediated learning, and in attitudes toward non-classroom uses of computers. However, no statistical difference based on gender was predicted in students' meaning-derived attitudes toward traditional (non-computer) classroom learning activities, or in attitudes toward affective activities. Hypothesis 2B posited that there would be no statistical difference based on gender in students' meaning-derived attitudes concerning the 12 Concepts on either the anxiety or complexity scales, but that there would be gender-based differences on the gender scale.

As in Hypothesis 1, Osgood D values were calculated using all 12 Concepts (which produced 66 D values) measured by the 15 bipolar scales, but here the responses were divided into two groupings: male and female respondents. Both gender groupings of D values were analyzed using Multidimensional Scaling (MDS), which produced "best fit" of two-dimensional Euclidean distance mappings of those D values (Figures 6 and 7, Appendices J1 and J2). Even though MDS maps the two gender groups with both axes "mirror-imaged" (reversed), visual analysis of the two mappings shows a virtually identical spatial relation among the 12 Concepts for male and female respondents.

For both genders, the Issue 'Computer-Mediated Instruction' (CMI) lies in the same position relative to the clusterings of the other three Issues: 'Traditional Classroom Learning Experience,' 'Activities Highly Associated With Affective Connotations,' and 'Experiences of

Computer Users.' Both genders show the same "written" versus "oral" positionings of the 'Traditional Classroom Experience' Issue, though females clustered "classroom oral report" somewhat closer to "classroom lecture" and "class discussion" than did males, who put "oral report" a little closer to the written classroom activities ("exams" and "papers"). Also, the clustering among the 'Experiences of Computer Users' differs slightly between genders, though the position of the Issue itself (vis-à-vis the other Issues) is virtually the same between them. For females, there is virtually no distance between "myself as a computer user" and "the Internet as entertainment"; whereas for males, there is almost no distance between "the Internet as entertainment" and "the Internet as source of information."

Hypothesis 2B dealt only with gender-related differences in responses to the three "non-Osgood" individual scales: anxious-confident, feminine-masculine, and simple-complex. A series of three One-way Analysis of Variance tests were run on the responses to each of the 12 Concepts, with responses to each of the three scales as dependent variables, and the nominal variable "gender" as the qualifying factor. Nominal alpha was set at .05 for each test. On the anxious-confident scale, none of the 12 Concepts showed a statistically significant difference between genders (see Appendix J3). On the feminine-masculine scale, a statistically significant difference was found on 11 of the 12 Concepts (see Appendix J4). (Concept 3, "the lecture/classroom component of this course," was the only one for which no difference ($p=.063$) was found.) On the simple-complex scale, a statistically significant difference was found on only 1 of the 12 Concepts (see Appendix J5). (Concept 8, "conversing with the instructor of this class," was the only one for which a difference ($p=.028$) was found.)

Table 11 and 12 show the female and male means for the gender and complexity scales for which statistically significant differences were found. In Table 11, a higher mean indicates the Concept was rated more "feminine" and a lower mean indicates the Concept was rated more "masculine." Similarly, in Table 12, a higher mean indicates the Concept was rated more "simple" and a lower mean indicates the Concept was rated more "complex." (No comparative means are given for those Concepts where no statistically significant difference was found between genders, as those means must be statistically treated as equal, and any observed or measured differences as merely anomalies of sampling or observation.)

Because no statistical gender-related difference was found among the four Issues, this study finds reason to reject Hypothesis 2A, which posited that there would be. However, the study finds sufficient evidence to accept Hypothesis 2B, which said there would be no gender-based differences on either the anxiety or complexity scales, but would be on the gender scale.

Table 11
Female and Male Means for **Gender** Scale for 11 Concepts

Concepts:		N	Mean
1. CMI – computer/lab component of this course	female	98	4.4388
	male	118	3.3475
	Total	216	3.8426
2. in-class small-group discussions	female	99	4.3434
	male	118	3.7119
	Total	217	4.0000
4. oral presentations of my own work in a course	female	98	4.6224
	male	119	3.3193
	Total	217	3.9078
5. writing term papers for a course	female	99	4.3838
	male	118	3.4237
	Total	217	3.8618
6. taking an examination in a course	female	98	4.3673
	male	117	3.6752
	Total	215	3.9907
7. socializing with friends outside of class	female	100	4.7800
	male	119	2.8487
	Total	219	3.7306
8. conversing with the instructor of this class	female	99	4.1717
	male	119	3.4706
	Total	218	3.7890
9. myself as a user of computers	female	99	4.6162
	male	119	2.9076
	Total	218	3.6835
10. e-mail as a communications tool	female	98	4.3265
	male	119	3.3445
	Total	217	3.7880
11. the Internet as an entertainment source	female	99	3.9899
	male	118	3.3559
	Total	217	3.6452
12. the Internet as a source of information	female	98	4.1531
	male	117	3.2479
	Total	215	3.6605

Table 12
Female and Male Means for **Complexity** Scale for 1 Concept

Concept:		N	Mean
8. conversing with instructor of this class	female	99	4.7677
	male	119	4.3109
	Total	218	4.5183

Hypotheses 3A and 3B

Hypothesis 3A posited that there are no statistically significant correlations between students' meaning-derived attitudes reported in the "anxious-confident" scale of the 'Computer-Mediated Instruction' (CMI) Issue and the attitudes reported in the "anxious-confident" scale of the two "non-computer" Issues--'Traditional Classroom Experiences' and 'Affective Activities.' Hypothesis 3B, by contrast, posited that statistically significant correlations do exist between students' meaning-derived attitudes reported in the "anxious-confident" scale of the 'Computer-Mediated Instruction' (CMI) Issue and the attitudes reported in the "anxious-confident" scale of the 'Non-Classroom Uses of Computers' Issue.

Means of the individual Concepts that make up the four Issues were calculated in order to have single values for each participant for the Issues 'CMI' (there is only one scale associated with this, so no mean calculation was necessary), 'Traditional Classroom Experiences,' 'Affective Activities,' and 'Non-Classroom Uses of Computers.' Pearson Product Moment Correlations were then calculated for these four calculated variables, the results of which are shown in Appendix K1. Table 13 shows both the predicted and actual levels of significant difference between the six possible combinations of Issues.

Table 13
Hypothesized and Actual Levels of Significant Correlations Among 4 Issues on "Anxiety" Scale

		CMI	**Traditional classroom**	**Affective activities**
Traditional classroom	Hypothesized:	**CORR**		
	Actual:	**CORR**		
Affective activities	Hypothesized:	**NO**		
	Actual:	**NO**	**CORR**	
Computer uses	Hypothesized:	**NO**		
	Actual:	**CORR**	**CORR**	**CORR**

CORR = correlated at a two-tailed significance level of .05
NO = not correlated at a two-tailed significance level of .05
blank = not hypothesized

The predicted statistically significant correlation on the "anxiety" scale between 'CMI' and 'Traditional Classroom Activities' was borne out (p=.000), as was the predicted lack of significant correlation on the "anxiety" scale between 'CMI' and 'Affective Activities' (p=.000). However, the hypothesis predicted no statistically significant correlation on the "anxiety" scale between 'CMI' and 'Non-Classroom Computer Uses,' when in fact a statistically significant correlation was found (p=.000). (While not part of the hypotheses, it should be noted that the other three possible pairings of these four Issues were found to correlate signficantly (p=.000) on the “Anxiety” scale.)

To help further bring into focus the relationship of responses to the “Anxiety” scale for the relevant Concepts and Issues, Osgood D values were calculated in two ways: (1) using all 12 Concepts (which produced 66 D values) measured solely by the “Anxiety” scale, and (2) collapsing the 12 Concepts down into their four Issues (which produced 6 D values). Both sets of D values were analyzed using Multidimensional Scaling (MDS), which produced “best fit” of two-dimensional Euclidean distance mappings of those D values (Figures 8 and 9, Appendices K2 and K3). As perhaps would have been expected, given the results of the Pearson Correlations, ‘CMI’ and the Concepts which compose ‘Affective Activities’ were at the extreme ends of a rather obvious axis (see Figure 8, Appendix K2), suggesting (as did the correlation calculations) that participants connected them least in their meaning-derived semantic space when focused on an “anxiety” scale. This relationship is shown yet again (Figure 9, Appendix K3) when the Concepts are reduced down to their parent Issues. CMI and affective activities are again at the extreme ends of the two-dimensional plotting.

As was the case in earlier MDS mappings which utilized all of the 15 scales (rather than just the one, “anxiety,” here), two items are worth note in Figure 8 (Appendix K2). First, the ‘Affective Activities’ Concepts seem to cluster with two of the three “oral” Concepts from the ‘Traditional Classroom Experiences’ Issue--“giving an oral report” and “participating in a class discussion.” The Concept “Class Lecture” has swapped ends of the axis on the “anxiety” scale, seated near ‘CMI’ for the first time. Second, while it could be interpreted that ‘Traditional Classroom Experiences’ and ‘Non-Classroom Uses of Computers’ form an axis of their own, it is also possible to read the MDS mapping as showing a crescent-shaped grouping, with ‘CMI’ at its core, branching out on one side to in-class activities, and on the other to non-classroom use of computers.

Therefore, this study finds sufficient evidence to reject Hypothesis 3A, which predicted no statistically significant correlation on the anxiety scale between the Issue of CMI and each of the two “non-computer” Issues (non-computer classroom activities and affective activities). But it finds sufficient evidence to accept Hypothesis 3B, which predicted a statistically significant correlation on the anxiety scale between the Issues of CMI and non-classroom uses of computers.

Hypotheses 4A and 4B

Hypothesis 4A posited that there is no statistical difference between students' and faculty's meaning-derived attitudes in ‘Computer-Mediated Instruction’ (CMI) and any of the other Issues identified in this study: ‘Traditional Classroom Experiences,’ ‘Non-Classroom Uses of Computers,’ or ‘Affective Activities.’ Hypothesis 4B posited that there would be no statistical difference between students and faculty in their meaning-derived attitudes concerning the 12 Concepts on the anxiety, gender, or complexity scales.

As in Hypotheses 1 and 2, Osgood D values were calculated using all 12 Concepts (which produced 66 D values) measured by the 15 bipolar scales, but here the responses were divided into two groupings: students and faculty respondents. Both groupings of D values were analyzed using Multidimensional Scaling (MDS), which produced “best fit” of two-dimensional Euclidean distance mappings of those D values (Figures 10 and 11, Appendices L1 and L2). As was the case with the gender comparisons referenced above, the MDS maps show the two groups with both axes “mirror-imaged” (reversed). However, unlike the gender results, visual analysis of the two mappings of students and faculty shows subtle but real differences in the spatial relations among the 12 Concepts.

The students' MDS (Figure 10, Appendix L1) shows the overall pattern seen previously, which is not a surprise since they form the overwhelming number of participants in the study. 'CMI' and the Concepts related to 'Affective Activities' form an axis, setting them opposed to one another in students' meaning-derived semantic space. Once again, 'Affective Activities' cluster with oral communication portions of the 'Traditional Classroom Experiences' ("class discussion," "class lecture," and "class oral report") showing that students find an affinity among them. 'CMI' clusters with the written communication aspects of the 'Traditional Classroom Experiences' ("taking an exam" and "writing a paper"), showing that students' meaning-derived semantic space aligns 'CMI' with written aspects of the classroom. Finally, Concepts associated with the Issue 'Non-Classroom Uses of Computer' ("student as user of computers," "the Internet as information source," "the Internet as entertainment source," and "using e-mail") are found clustered, and in an axis opposed to "oral" aspects of the 'Traditional Classroom Experiences.'

In their MDS mapping (Figure 11, Appendix L2), faculty, on the other hand, seem to have found certain discriminations and associations that students did not find, creating differing clustering and axes. For example, in their meaning-derived semantic space, they found differences among the five Concepts that make up the 'Traditional Classroom Experiences,' scattering them in three different quadrants. "Writing a paper" and "class discussion" are grouped, and are at the end of an axis bordered on the other end by "oral reports" and "class lecture." Another axis not described by students is one the faculty made bordered by "the Internet as entertainment source" and "the Internet as information source." Faculty seemingly did not associate the two Concepts of the Issue 'Affective Activities' ("talking with friends" and "talking with students"), though (similar to students), faculty placed 'CMI' and one Concept of 'Affective Activities' ("talking with friends") at opposite ends of an axis.

Hypothesis 4B dealt only with differences between students and faculty in responses to the three "non-Osgood" individual scales: anxious-confident, feminine-masculine, and simple-complex. A series of three One-way Analysis of Variance tests were run on the responses to each of the 12 Concepts, with responses to each of the three scales as dependent variables, and the nominal variable of "student-faculty" as the qualifying factor. Nominal alpha was set at .05 for each test. On the anxious-confident scale, a statistically significant difference was found on only one of the 12 Concepts (see Appendix L3). (Concept 4, "oral presentations of my own work in a course," was the only one for which a difference ($p=.0476$) was found.) On the feminine-masculine scale, none of the 12 Concepts showed a statistically significant difference between genders (see Appendix L4). On the simple-complex scale, a statistically significant difference was found on three of the 12 Concepts (see Appendix L5). Tables 14 and 15 show the student and faculty means for the anxiety and complexity scales for which statistically significant differences were found.

Table 14
Student and Faculty Means for **Anxiety** Scale for One Concept

Concepts:		**N**	**Mean**
4. Oral presentations of my own work in a course	students	227	4.881057
	faculty	9	6.000000
	Total	236	4.923729

Table 15
Student and Faculty Means for **Complexity** Scale for Three Concepts

Concepts:		N	Mean
2. In-class small-group discussions	students	226	4.371681
	faculty	9	3.222222
	Total	235	4.327660
9. Myself as a user of computers	students	228	3.622807
	faculty	9	2.444444
	Total	237	3.578059
12. The Internet as a source of information	students	227	3.986784
	faculty	9	2.555556
	Total	236	3.932203

In Table 14, a higher mean indicates the Concept was rated more "confident" and a lower mean indicates the Concept was rated more "anxious." Similarly, in Table 15, a higher mean indicates the Concept was rated more "simple" and a lower mean indicates the Concept was rated more "complex." (No comparative means are given for those Concepts where no statistically significant difference was found between genders, as those means must be statistically treated as equal, and any observed or measured differences as merely anomalies of sampling or observation.)

Therefore, this study finds evidence to reject Hypothesis 4A that there is no difference between students' and faculty's attitudes on the overall 12 Concepts. However, in general, this study finds evidence to accept Hypothesis 4B, stating that there is no difference between students' and faculty's attitudes on the gender, anxiety, and complexity scales.

Summary

The results of the study show support that, of all four of the Concepts considered, computer-mediated instruction (CMI) activities sit furthest away from activities that are highly affective-laden. The study found no compelling evidence to suggest gender-based statistical differences in any of the meaning-derived attitudes expressed, whether in the entire grouping of 12 Concepts measured by all 15 scales, or on the concepts based solely on the individual anxiety or complexity scales. There were distinct and statistically significant gender-based differences on the gender scale. Further disparity between the Issues of CMI and affective activities in that responses to the CMI Issue correlated statistically significantly to each of the other Issues with the sole exception of affective activities. Regarding responses by students and faculty, the study found conceptual statistical differences in how each group conceived and semantically spaced the 12 Concepts, but (in general) found no statistical difference between the two groups on the anxiety, gender, and complexity scales.

CHAPTER FIVE
DISCUSSION

This chapter first provides an in depth discussion of the results of the study, detailed in the previous chapter-- including reliability findings of the current instrument, Issues related to missing data, analysis of the findings related to the study's four hypotheses, and the exploratory factor analysis studies done which were ancillary to the main study. Following this come a wide-ranging series of recommendations for future research which come from the results of the current study.

Reliability and Missing Data

Results of both the Reliability Scales--alpha and split half--demonstrated the current Semantic Differential (SD) scale to have high reliability quotients. The alpha of .9555 and the split-half alphas of .9336 and .9251 are consistent with a series of early studies done by, for, under the supervision of, and by others after the initial work of Osgood (e.g., Osgood, et al., 1957; Snider & Osgood, 1969). This confirmation of the historically authenticated reliability of the SD as a measurement type came, therefore, as no surprise.

The solution of dealing with records with missing data by discarding them seemed to be amply borne out as the correct solution. Because the calculation of the Osgood D value would unquestionably have been made inaccurate by the existence of missing data, only two possible solutions presented themselves--find some appropriate value to fill in for those items where there were missing data, or discard the record altogether. While some logic could be found in the argument for inserting the middle (or 4, in a 1 to 7 scale) value for any scale that had been left blank--based on the theoretical underpinnings of Osgood's (Osgood, et al., 1957) SD creation, as well as his instructions to participants filling out a SD survey--nevertheless, the overriding concern in this study was to preserve actual, in tact participant data. Therefore, using only those records that did not contain missing data was seen as the best solution, as long as it could be determined that eliminating records which contained missing data did not terribly change the overall structure (demographically or psychographically).

The results of various testing seemed to demonstrate with relative certainty that the group comprising only those records without missing data did not differ significantly from the entire group of respondents. The full range of 66 Osgood D values were computed for both groups (Group 1 (n=237) comprising all records including those with missing values and Group 2 (n=186) comprising only those records with no missing values). A series of 66 Mann-Whitney/Wilcoxon tests revealed no statistically significant difference in any of those pairings. Demographic comparisons further showed the two groups to be virtually identical in gender breakdown, class year distribution, and in mean, median, and distribution of expected grade in the course. Therefore it was seen as permissible (i.e., extremely likely to produce results identical to what would have been given by the entire set of participants) to use only those records without missing data.

Hypothesis 1

This study predicted a structured, hierarchical "similarity-dissimilarity" relationship between participants' meaning-derived attitudes toward the 'Computer-Mediated Instruction' Issue and the other three Issues covered in the study, 'Traditional Classroom Activities,' 'Non-Classroom Computer Activities,' and 'Affective Activities,' where each of these last three Issues would be progressively less similar to attitudes toward CMI. This relationship was, to a large extent, confirmed.

The linearized, one-dimensional MDS mappings of participants' meaning-derived attitudes to the four Issues (see Figures 4 and 5, Appendices I3 and I4) clearly shows that hierarchical relationship. These MDS mappings suggest that CMI is most closely related in participants' meaning-derived attitudes to 'Traditional Classroom Activities,' which perhaps indicates that participants more closely associate their CMI experiences (which, in this study, were individualized portions of traditional courses) with those traditional learning experiences than they do with non-classroom uses of computers or (certainly) affective-laden activities. The linear Euclidean mappings (Figures 4 and 5) also suggest that participants closely associate non-classroom uses of computers--in fact sits in the middle between--the Issues of 'Non-computer classroom learning' (perhaps because of the "Internet as information source" component?) and 'Affective Activities' (perhaps because of the "Using E-mail" and "Internet as Entertainment Source" components?). As such, these linear MDS mappings by themselves show strong support for the posited relationships stated in Hypothesis 1.

However, when the four Issues are dissolved down to the 12 Concepts they comprise, the MDS mappings are a little more ambiguous regarding the proposed relationships. The axis formed by CMI on one end, and the two Concepts which make up the 'Affective Activities' Issue ("Socializing With Friends" and "Talking With Professor") at the other end is still stark and uncompromising. Clearly, however participants were conceiving these two 'Affective Activities' Concepts (alternatives are considered below), they viewed them as least like their meaning-derived attitudes toward CMI. What significance does this have? As the goal of this study was primarily to determine any semantic identities or causalities between CMI and the Affective Domain, and if it can be taken as given that the operationalizing of the Affective Domain in this study (in the form of these two Concepts) was appropriate and sufficient, then clearly the conclusion must be drawn that participants viewed very little meaning-derived semantic relationship between CMI and the Affective Domain. Therefore, if these premises and conclusions are true, then these results speak cogently concerning what it will take to carry Ireland's (1999) findings about integration of the Affective Domain into CMI to the next level. Clearly, participants found little in common between CMI and these behavioristic examples of 'Affective Activities.' And if there is, therefore, no intrinsic meaning-derived affinity between CMI and these 'Affective Activities,' the curricularist for computer-mediated instruction will need to factor this disparity into the planning--apparently in ways that the curricularist for traditional learning does not need.

Is it true that there are intrinsic links to 'Affective Activities' in traditional classroom activities that are not found in CMI? If the study's premises are correct, the MDS mappings seem to indicate a possible "yes" to this question. Figure 2 shows clearly that participants make that very connection. Clustered with the two Concepts that make up the 'Affective Activities' Issue are three Concepts that are undeniably part of 'Traditional Classroom Experiences' ("class discussion," "class lecture," and "oral reports"). These five clustered Concepts are all at the opposite end of an axis with CMI, which itself is clustered with the other two 'Traditional Classroom Experiences' Concepts ("taking an exam" and "writing a paper"). Participants have drawn an undeniable dichotomy between written and oral portions of the 'Traditional Classroom Experience,' and have linked the written portion with CMI and the oral portion with the Concepts that make up the 'Affective Activities" Issue. There are at least two possible explanations for this phenomenon, neither of which readily emerges as more plausible than the other:

- Participants have divided these 'Traditional Classroom Experiences' into two groups because they gain the same types of (affectively laden?) benefits from the oral activities as they do from strongly Affective activities, and (by contrast) they gain the least amount of those (affectively laden?) benefits either from the written activities or from CMI; or

- Participants simply and naturally bifurcate written and oral aspects of the 'Traditional Classroom Experiences,' and the CMI and 'Affective Activities' aligned themselves with each section because of similarities perceived by participants between each.

If the latter were true, what might those similarities be? Clearly, CMI is (at the present time, at least) a written medium, and that participants would pair it with the written portions of 'Traditional Classroom Experiences' seems natural and logical. The pairing at the other end of the axis, however, might be a little more problematic. It could be that participants found oral activities more affectively laden, but it is also possible, of course, that the clustering at this end of the axis came about precisely because they did *not* react to the *affective* components "socializing with friends" and "talking with professor" but rather to the "oral" nature of the activities. This would explain the strong dichotomous mapping between CMI/written and "affective"/oral, and would have to be taken into consideration as a possibility by any curricularist seeking to use these results for writing CMI.

The final notable result in the MDS mapping (Figure 2) is the clustering and isolation of all of the Concepts that formulated the Issue 'Non-Classroom Uses of Computers.' Not only did participants describe highly similar meaning-derived attitudes about all of them, but they placed them at one end of a secondary axis, anchored on the other end by the "oral" Concepts from the 'Traditional Classroom Experiences' Issue. Not only is this a repetition of the previously observed "oral" versus "written" (computer use seen as a written medium) dichotomy, but it is a fairly dramatic illustration of participants' meaning-derived "isolation" of their use of the computers and all the other Concepts examined in this study. That computer use appears to be holistic, monothematic, and isolated from these other behaviors.

Hypotheses 2A and 2B

This study made two predictions related to gender-based differences in meaning-derived attitudes concerning the Concepts and Issues examined. First, it was predicted that the genders would differ in their meaning-derived attitudes toward the Issues of 'Computer-Mediated Instruction' (CMI) and 'Non-Classroom Uses of Computers,' but that there would be *no* gender-based differences in meaning-derived attitudes concerning the Issues 'Traditional Classroom Experiences' and 'Affective Activities.' Second, this study predicted no gender-based differences any of the 12 Concepts on either the anxiety or complexity scales, but that there would be differences on the gender scale.

Examination of the two MDS mappings done for female (Figure 6, Appendix J1) and male (Figure 7, Appendix J2) participants reveals an almost identical semantic spacing among the 12 Concepts. Even though the computer MDS process mapped the two "mirror image" to each other, it does not take much imagination to see that the axes and clusterings identified above in the discussion about Hypothesis 1 results are present and virtually identical to each other. The Concepts related to the Issue 'Traditional Classroom Experiences' divide themselves into "oral" and "written" for both, and each is clustered with the 'Affective Activities' and 'CMI' the same for both. Also, the Concepts related to the Issue 'Non-Computer Uses of Computer' clustered virtually identically for both.

At least for these Concepts, in this location, among these participants, the predicted variances between male and female participants in relation to CMI, 'Non-Classroom Uses of Computer,' or the relative interactions of these two with any of the other Concepts simply did not appear. Only one minor discrepancy strikes the eye and seems worth mentioning, and that is the fact that for males, the Concept "oral report" seems less "clustered" with other "oral" Concepts than for females. Because the fear of public speaking is widely known to be so pervasive and strong, one possibility might have been that males and females differed somehow in fear of this part of 'Traditional Classroom Experiences." However, this seems not to be borne out by the fact that no significant difference (at the .05 level) was found between the genders on the Concept "oral report" on the anxiety scale. And in fact, this one anomaly between the male and female mappings is so slight, and so dwarfed by the overwhelming "sameness" between them, it hardly seems a major issue.

When testing gender-based differences on the 12 Concepts, as rated on the three "non-Osgood" scales, the predicted results did, in fact, occur. No statistically significant gender-based differences were found for the 12 Concepts on the anxiety scale (as predicted), and significant difference was found for only one of the Concepts on the complexity scale (almost exactly as predicted). Because of the polarity for the "simple-complex" scale used in the survey form, the results showed that females found "conversing with instructor" a significantly simpler behavior than did males (p=.028). Suggesting reasons for this finding is beyond the scope of this study, but perhaps the it is indicative of some sort of socialized behavior pattern which gives females greater ease in this situation. Also almost exactly as predicted, statistically significant gender-based differences were found on eleven for the 12 Concepts on the gender scale. Because of the polarity for the "feminine-masculine" scale used in the survey form, the results showed that females found these eleven Concepts significantly more "feminine" in this semantic space, and males found these eleven Concepts significantly more "masculine." (See Table 11 and Appendix J4.) The only Concept that produced no gender-based difference was "lecture component of class," and again, one or two possible reasons for this one anomaly suggest themselves. First, and possibly most likely, the concept of the "lecture component" is a truly "external" thing equally for both males and females. It might be that each perceives it identically (and therefore gender neutral) because there is no obvious gender component to it. Another possibility may explain not only this one exception, but also why the other eleven Concepts were seen in such gender specific ways. Several of the Concepts were worded with "me" or "my" imbedded or implied (e.g., "myself as a user of computers," "conversing with [my] friends"). On the SD's 1 to 7 scale, females rated "myself as a user of computers" a whopping 4.6 (far on the "feminine side") and males a mirror image whopping 2.9 (far on the "masculine side"). The self-identification inherent in a Concept like that seems almost certain to produce gender-based bifurcated responses. Indeed, it is easy to wonder why, on that Concept, the mean for females wasn't 7.0 and the mean for males wasn't 1.0 !

Use can be made of the fact that there was one Concept which did not produce a statistically significant gender-based difference, "lecture component of this course," in further interpreting the MDS mappings for females and males. Since this can be seen as at least one area where this set of participants did *not* find a gender difference, we can see significance to the fact that this Concept sits in relatively the same position vis-à-vis the axes (albeit mirror imaged, which is irrelevant). Upon examination, it can be easily seen that the mappings (and distances) of all of the other Concepts, when viewed in relation to that one "constant" positioning, are again identical. This then seems further concrete proof that, in their overall meaning-derived attitudes toward the Concepts in this study, there is no difference between females and males.

Hypotheses 3A and 3B

This study made two predictions related to differences in participants' meaning-derived attitudes about the four identified Issues drawn specifically from the "anxious-confident" scale. It was posited that the anxiety scale for the 'Computer-Mediated Instruction' (CMI) Issue would correlate significantly with anxiety scale for the 'Traditional Classroom Experience' Issue, but would *not* correlate significantly with anxiety scales for the 'Affective Activities' or 'Non-

Classroom Use of Computer' Issues.

The predictions related to correlation relationships among the four Issues were only partially verified. The Issues 'CMI' and 'Affective Activities' were the only ones for which no actual statistically significant correlation was found, relating with a truly poor Pearson r value of 0.066. This confirms and underscores all of the findings from the previous Hypotheses that 'CMI' and 'Affective Activities' are, for the purposes of and as operationalized in this study, widely divergent, not correlated, and at opposite ends of meaning-derived semantic space axes. Whatever underlying conceptualization that was tapped into by the Concepts related to "Affective Activities," it is clearly not reflected in participants' conceptualization of 'CMI.' Assuming that participants did, at some level, pull affective-laden behaviors as their reading of these Concepts, again it seems safe to say that curricularists intent on adding Affective content into CMI learning experiences have barriers to cross.

That 'CMI' correlated at significant levels with 'Traditional Classroom Experiences' (as predicted) and with 'Non-Classroom Computer Uses' (not predicted) may perhaps be explained by an assumption that someone who is likely to have high (or low) anxiety on one of these Issues may be equally likely to have the same level (or predict a similar level) for the others. The seeming "crescent clustering" of the twelve-Concept MDS when measured on the "anxiety" scale (Figure 9, Appendix K2) which spans 3/5 of the Concepts in 'Traditional Classroom Experiences,' 'CMI,' and all of 'Non-Classroom Computer Uses' might be a confirmatory fact. The MDS mapping's confirmation of the isolation of 'Affective Activities' (along with the "oral" Concepts of "oral report" and "class discussion") once again points to this fact as a key outcome and result of this study.

Hypotheses 4A and 4B

This study made two predictions related to differences in meaning-derived attitudes between students and faculty concerning the Concepts and Issues examined. First, it was predicted students and faculty would not differ in their meaning-derived attitudes toward any of the four Issues of the study: 'Computer-Mediated Instruction' (CMI), 'Traditional Classroom Experiences,' 'Non-Classroom Uses of Computers,' and 'Affective Activities.' Second, this study predicted no differences between students and faculty in their meaning-derived attitudes concerning any of the 12 Concepts based on the anxiety, gender, or complexity scales.

Contrary to what the study predicted, there were some differences (some subtle, some substantive) between students and faculty in their meaning-derived attitudes of the 12 Concepts of the study. Students' MDS mapping (Figure 10, Appendix L1) was virtually indistinguishable from the overall participants' mapping discussed above under Hypothesis 1. There is the axis formed by 'CMI' and the Concepts related to 'Affective Activities' on the other. "Written" elements of 'Traditional Classroom Experiences' cluster with 'CMI,' but "oral" elements cluster with 'Affective Activities.' The Concepts related to 'Non-Classroom Uses of Computer' cluster to themselves. (A complete discussion of these results is found above.)

Faculty, on the other hand, seemed to view, categorize, and divulge a meaning-derived semantic space for the 12 Concepts in a different way. None of the three Issues which comprise multiple Concepts were mapped in clusters. Assuming the MDS mappings fairly and accurately reflected faculty's meaning-derived attitudes, their conceptualizations of the Concepts were quite different both from students' reportings and from the way they were theoretically conceived for this study. There is, of course, the possibility that the faculty who completed this survey were not a cohesive or homogeneous group in their attitudes, and therefore the MDS mapping would not reflect a unity of attitude. Nevertheless, some patterns do seem to suggest themselves in the faculty MDS mapping, and are perhaps worth considering. Faculty apparently see 'CMI' and

“Internet as information source” virtually identically, as they map almost on top of one another. Flanking these two, though not exactly forming a tight cluster, are elements from the Issue ‘Traditional Classroom Experiences’--“oral report,” “class lecture,” and “class exam.” This loose clustering might be thought of as “scholarly” or “academic.” At the other end of an axis from this point appears to be a cluster defined by “entertainment,” comprising “Internet as entertainment,” “socializing with friends,” and “using e-mail.” Other Concepts associated with the Issues ‘Non-Classroom Uses of Computer’ and ‘Traditional Classroom Experiences’ are scattered out over the breadth of the mapping, and do not readily suggest a pattern. More research to probe the meaning-derived semantic attitudes of faculty seems called for. (See discussion below.)

Comparing responses to the 12 Concepts using the three “non-Osgood” scales (anxiety, gender, and complexity) suggested more homogeneity of thought and attitude between students and faculty. In the “anxiety” scale, not surprisingly the only Concept for which there was a statistically significant difference between student and faculty responses was “oral presentations of my own work” (p=.0476). Faculty reported an almost-off-the-scale mean of 6.0 (on a 1-to-7 scale), indicating great confidence in this area. Not surprising, as this is what faculty do for a living and have presumably had many years experience. Students were on the “confident” side, but their mean was lower at 4.9. No statistically significant differences were found between students and faculty for the 12 Concepts using the gender scale. And in only three of the 12 Concepts were statistically significant differences found between students and faculty using the simple-complex scale. The three Concepts were “group discussions” (p=.0396), “myself as user of computers” (p=.0405), and “Internet as source of information” (p=.0349). In none of these did either faculty or students rate the Concept particularly high on the “simple” side, preferring to stay in the middle or leaning toward “complex.” And, perhaps tellingly (since two of them have to do with computer usage) faculty rated all three as significantly “more complex” than did students. However, even with these few differences (which might have purely been as a result of the “luck of the draw” of samples), it seems safe to assert that the study’s prediction of no difference between student and faculty in these areas of anxiety, gender, and complexity was (almost completely) validated (the Hypothesis was accepted).

Factor Analytic Studies

The focus of the current study was not a replication either of the numerous factor analytic studies which were part of the creation of the SD or of those which have dotted the landscape since its inception (Osgood, et al., 1957; Snider & Osgood, 1969)--that is, to test and replicate what Carroll called the “dimensionality of the semantic space” (Carroll, 1969, p.104). Nevertheless, for the sake of completeness, and in order to see if the current study situates itself in the same theoretical (e.g., factoral) construct that previous SD studies have done, three exploratory factor analysis studies were done on the SD data collected in this study. Based on previous studies, it would have been expected that all individual scales would reduce to and describe three factors, following the pattern of Evaluative-Potency-Activity (E-P-A) pattern previously established. Overall, scales from the current study showed adherence to the major factoral “skeleton” found in previous studies, but with consistent (if minor) aberrations in the details.

As shown in Table 8, the 12 bipolar scales in the current study, which had been drawn directly from E-P-A factorings in previous studies, reduced to and described only two factors, rather than the expected three. In short, the scales previously associated with the Evaluative and Activity factors (along with the “strong-weak” bipolar scale, which came from the Potency factor) combined into one large single factor. The three remaining Potency scales (“heavy-light,” “hard-soft”, and “large-small”) created a second factor by themselves.

This dissolution of the previously drawn (and expected) separate Evaluative and Activity factors into a single factor bears scrutiny. One possible (and potentially most plausible) explanation is that participants in the study conceived of "activity"-type scales (e.g., shard-dull, active-passive, fast-slow) as just further types of evaluations (affective or cognitive valuings) similar to pleasant-unpleasant and honest-dishonest. (The same could be said for the strong-weak scale, which in the current study fell into this mammoth Evaluative factor.) The vanishing of an entire factor (so ubiquitously found in early SD studies) in a modern study may point to a shift in meaning-derived Conceptions among students, or it could be simply that this particular group of participants were (collectively) simply less semantically discriminating than previous sets of subjects.

Regardless of which of the above reasons might prove valid in explaining the merging of Evaluative and Activity factors, there nevertheless remains the question of why the Potency factor emerged almost exactly as theoretically predicted. Again, one theory might be that the Potency factor is sufficiently "hardwired" (cognitively and semantically) into the language that it would emerge regardless of other intervening factors. However, taking into account what appears to be an integrative tendency on the part of the present participants, there may be an alternative and equally compelling explanation.

As noted from the very beginnings of the use of SD as a measurement tool, it can require a certain amount of metaphorical stretch and association on the part of the participants. “A scale like *large-small* is liable to strict denotative usage in judging physical objects like BOULDER and ANT, but is likely to be used connotatively in judging Concepts like SIN and TRUMAN” (Osgood, et al., 1957p. 79). In a study of this phenomenon, Brown (1969) gave subjects a list of 20 Concepts (e.g., lady, boulder, sin) and a list of 50 bipolar SD scales (e.g., good-bad, sweet-sour, active-passive) on which to judge each Concept.

> A few of these 1,000 judgments (50 scales x 20 concepts) were quite prosaic; e.g., deciding whether boulder is light or heavy. In the majority of cases, however, the scales could not be said to have any ‘literal’ application to the concepts and subjects had to extend themselves to think in metaphors and difficult-to-explain associations. Does *sin* seem to be *red* or *green*? Is a *boulder sweet* or *sour*? (p.85)

Similarly, Weinreich (1969) asked “Is a knife humble or proud?” (p.117). Both Brown and Weinreich came to similar conclusions, which was that subjects who are able and willing (and instructed) to think metaphorically when the association between concept and scale is not immediately appropriate (“knife” on humble-proud, as opposed to the more appropriate “feather” on light-heavy), the results turn out to be “surprisingly reliable” in relation to the expected E-P-A factorings (Weinreich, 1969, p. 117).

When looking at the specific Concepts examined in this study, and the scales used to measure them, a case could be made, perhaps, that three of the four original Potency scales (the ones which loaded into the second factor in the current study; “hard-soft,” “heavy-light,” and “large-small”) presented participants with sufficiently “concrete sense” (i.e., non-abstract, lacking in necessity for metaphor) that they used them as a block, and therefore created a “factor” with them? And if so, what about the scales that all loaded into the large first factor? Could the study, through its selection of SD bipolar scales and use of certain specific (and perhaps abstruse) Concepts have taxed the participants’ ability to make the appropriate connections? Did this study see the fruits of a newer generation of students, less capable than in the time of Osgood of making abstract cognitive or semantic judgments? Was it unfair to give a concept like “myself as a user of computers” and ask students to place it on semantic scales such as “valuable-worthless” or “fair-unfair”? Was it wishful thinking to believe participants could have seen a

Concept such as “socializing with friends” and rate it on “large-small” or “sharp-dull”?

There were three additional bipolar scales used in this study beyond the 12 analyzed above, representing anxiety ("confident-anxious"), gender ("feminine-masculine"), and complexity ("simple-complex"). When these three scales were added to the original 12 for factor analysis, the two factors emerged again, this time with the anxiety scale in the first large omnibus factor, and both the complexity and gender factors in the second. (See Table 9.) Because a third factor was hinted at, with an Eigenvalue of .978, and so a factor analysis that forced a third factor dropped the gender (alone) down to form a third factor. (See Table 10.) Thus, all three of the study’s “non-Osgood” scales (anxiety, complexity, and gender) found their way into three separate factors. This may not have significance beyond the fact that it shows the three “non-Osgood” scales were discrete from each other, and probably each measured very little of what its companions were measuring. Thus, more concrete information can be said to have been obtained from the participants, justifying the use of the three additional “non-Osgood” factors.

Implications for Future Studies

While it seems as though this study has uncovered several new insights and information concerning the interrelationship and interaction (or lack thereof) between Computer-Mediated Instruction and the Affective Domain, as well as how they are perceived in relation to other Concepts such as “Traditional Classroom Experiences” and “Non-Classroom Uses of Computers,” part of the success of this study has been its heuristic value. In peeling away a few of the layers, what has been learned has created a sheaf of questions suitable for future research.

Since this study had as its main goal to examine the intrinsic relationship between CMI and the Affective Domain, clearly one question that could be answered by follow-up studies is to what extent the operationalizing of “affect” in the current study was on the mark. Were participants able to make the cognitive (or semantic) leap to pull the affective aspects of the Concepts utilized in order to draw out their own (perhaps even unknown) affective reactions from them? Would this study bear replication? And if so, how can the operationalizings be fine tuned to make sure participants are responding to what is hoped for? Alternatively, is there some other way that behavior-driven manifestations of affective components (e.g., valuing), such as those elucidated by Kaplan (1986) in his Taxonomy of Affective Behaviors (TAB), can be identified, operationalized, and measured?

The root of this study has been tapping into and using participants’ “meaning-derived” attitudes through the Semantic Differential (SD) inventory. As described above, the history of the SD has been one of uncertainty that participants can (and do) make the sufficiently abstract leap into metaphor in order to really gain true insights into semantic complexities. *“Is a boulder sweet or sour?* (Brown, 1965, p.85). Assuming that it is deemed worthy and useful to continue research into the Affective component of Computer-Mediated Instruction (case to be finalized below), questions must be asked as to whether that inherent limitation in the SD is sufficient to make it not as useful as other measurement tools for this purpose. If so, what other psychographic measurement tool would work, and how can a preference for it be made above the SD?

And surely, in the light of recent research (including this study), a strong case can be made for the efficacy of examining the role of the Affective Domain in Computer-Mediated Instruction. A series of studies have shown that the addition of affective components into a traditional curriculum can have measurable, positive, and surprisingly positive effects on the amount of cognitive learning that takes place (e.g., Pettapiece, 1992; Ruck, 1996). More recently, Ireland (1999) proved the next logical step, which is that the same addition of affective components into computer-mediated instruction can have similar effects on the cognitive learning in that arena. The current study has taken a first step toward delineating what the relationship is between Affect and CMI, suggesting that CMI and 'Affective Activities' are often at polar ends of semantic spatial relations. And of course there is the intriguing question of why "oral" aspects of traditional classroom experiences clustered with affective activities, and why "written" clustered with CMI. Further understanding of these could be invaluable if educators are going to be able to effectively use these techniques to maximize the effectiveness of CMI.

The current study has also hinted at other areas of research that might be fruitful. For example, there is the question of the relationship between CMI (which certainly uses the student as a "user of computers") and this study's 'Non-Classroom Use of Computers.' Participants seemed to keep these Issues semantically separated and isolated from one another, hinting that there is a meaning-derived wall that has been erected between them in their conceptualizations. What is that wall? Why is it there? Is it shrinking, with newer technologies? In five years, will students really see a difference between themselves as users of computer inside and outside the classroom? If they do not, is this good or will it have a deleterious effect on actual cognitive learning through CMI?

Also, some previously believed "truisms" about the separation (and therefore compartmentalization of skills and conceptions) of male and female abilities/interest/self-report concerning use of computers (including CMI) seem not to have been borne out in this study. Are the studies that find and report gender-based differences tapping into socialization or "self-expectations"? Could it be that SD provides a way of reporting psychographic information of this kind that is not side-tracked by that sort of thing? And, perhaps most interesting of all, how is it that the only major differences between males and females in this study came on the "gender" scale? Can this be explained merely by the fact that some Concepts involved "me" or "my," thus "forcing" each to answer according to his/her own gender? Or did this perhaps tap into something basis in the participants' semantic spaces, that truly identified with these activities (Concepts) so much that they "felt" like the Concepts belonged to their own gender?

And finally, the differences found in the MDS mapping between students and faculty in this study point to the need for exploring how faculty specifically view and conceptualize these issues. What are the factors that vary the perceptions among faculty (e.g., experience, department, age, gender, etc.)? As it will be the faculty who will be the curricularists for the creation of all present and future CMI, research can help them understand themselves, their own strengths and challenges, and their students (and how they differ). Coupled with other information (such as the role of the Affective Domain in cognitive learning and in CMI), faculty can be better equipped for their roles, and students can be better served.

Conclusions

To what end, then, has this study come? While it never had as its goal to answer all questions relative to the Concepts it was studying, this research did manage to find quite significant evidence for linkages and interrelationships in areas important to all of education, and specifically to the future of computer-mediated instruction. It has uncovered evidence for relationships between and among conceptualizations that are important to the field of curriculum design, pedagogy in general, and the further use of computer-mediated instruction in specific. The literature has said decisively that the deliberate infusion of affective components into curriculum can and does increase cognitive learning levels. This study has shown conclusively (in several ways, across conceptual lines, bridging gender categories, and for those with varying degrees of computer anxiety) that participants' meaning-derived attitudes place CMI and the elements associated with the affective domain almost at polar ends of their semantic continuum. The implications for this, in terms of how and if it will be possible for curricularists to actively and effectively introduce behaviorally quantifiable affective elements into CMI-based curriculum, seem worthy of note. Also, the findings of this study squarely sit with the great (but by no means exclusive) body of research that finds, on the whole, no differences between men and women in their reactions to and attitudes about computers in general, and computer-mediated learning in specific. Further, this study has found the beginnings of verification that students and faculty conceive of the Issues and Concepts studied in this research in very different and (at times) fundamental ways. Further exploration of how and why this is, and ways that faculty can bridge the gap in order to design curriculum which meets students' needs, expectations, and internal gestalt seems imperative. Finally, it seems safe to say that this study has adequately and provocatively provided heuristic plenty of possible research directions and theoretical musings over the presence or absence of the affective factor inside education which does not include a live human teacher.

APPENDIX A

Survey Instrument
For Student Participants

(following pages)

Northwood University Survey

Gender: 1 ☐ female 2 ☐ male Course and section number:__________________

Your current class status:
1 ☐ freshman 2 ☐ sophomore 3 ☐ junior 4 ☐ senior

In this course, I expect a grade of:

☐ A	☐ A-	☐ B+	☐ B	☐ B-	☐ C+	☐ C	☐ C-	☐ D+	☐ D	☐ D-	☐ F
4.0	3.7	3.3	3.0	2.7	2.3	2.0	1.7	1.3	1.0	0.7	0

INSTRUCTIONS
Please fill out the above information, read the following instructions, and then proceed to the rest of the survey.

This survey is part of a study to measure what certain things mean to various people. On the following pages, a series of concepts appear in boxes, with rating scales to the right of each box. On the basis of what each concept means to you, please mark the accompanying scales.

Rate the concepts in order; don't skip ahead or go back.

Here is how you are to use the scales:
If you feel that the concept at the left is very closely related to one end of the scale, place your "X" as follows:

SOCIALISM fair _X_:___:___:___:___:___:___ unfair
or
fair ___:___:___:___:___:___:_X_ unfair

If you feel that the concept is quite closely related (but not extremely) to one or the other end of the scale, place your "X" as follows:

HAMMER strong ___:_X_:___:___:___:___:___ weak
or
strong ___:___:___:___:___:_X_:___ weak

If the concept seems only slightly related to one side as opposed to the other side (but is not really neutral), place your "X" as follows:

RADIO cold ___:___:_X_:___:___:___:___ hot
or
cold ___:___:___:___:_X_:___:___ hot

(The direction toward which you check, of course, depends upon which of the two ends of the scale seems most characteristic of the thing you're judging.)

If you consider the concept neutral on the scale, or feel both sides of the scale are equally associated with the concept, or consider the scale completely irrelevant or unrelated to the concept, place your "X" in the middle space:

PEOPLE cruel ___:___:___:_X_:___:___:___ kind

IMPORTANT: Place your "X" on the line, not on the boundary:

this ___:___:_X_ not this ___X___

Please work quickly (recording your first impressions),
answer every question, and place only one mark per question.

Do not worry or puzzle over individual items. It is your first impressions, the immediate "feelings" about the items, that we want. On the other hand, please do not be careless, because we want your true impressions. Thank you.

Socializing with friends outside of class.

active	____:____:____:____:____:____:____	passive
hard	____:____:____:____:____:____:____	soft
worthless	____:____:____:____:____:____:____	valuable
sharp	____:____:____:____:____:____:____	dull
good	____:____:____:____:____:____:____	bad
masculine	____:____:____:____:____:____:____	feminine
small	____:____:____:____:____:____:____	large
weak	____:____:____:____:____:____:____	strong
simple	____:____:____:____:____:____:____	complex
anxious	____:____:____:____:____:____:____	confident
heavy	____:____:____:____:____:____:____	light
slow	____:____:____:____:____:____:____	fast
pleasant	____:____:____:____:____:____:____	unpleasant
dishonest	____:____:____:____:____:____:____	honest
fair	____:____:____:____:____:____:____	unfair

Myself as a user of computers.

unfair	____:____:____:____:____:____:____	fair
fast	____:____:____:____:____:____:____	slow
large	____:____:____:____:____:____:____	small
passive	____:____:____:____:____:____:____	active
valuable	____:____:____:____:____:____:____	worthless
unpleasant	____:____:____:____:____:____:____	pleasant
soft	____:____:____:____:____:____:____	hard
honest	____:____:____:____:____:____:____	dishonest
confident	____:____:____:____:____:____:____	anxious
dull	____:____:____:____:____:____:____	sharp
strong	____:____:____:____:____:____:____	weak
feminine	____:____:____:____:____:____:____	masculine
bad	____:____:____:____:____:____:____	good
light	____:____:____:____:____:____:____	heavy
complex	____:____:____:____:____:____:____	simple

Remember:
Work quickly. Answer every question.
Record your immediate impressions.
Go with your feelings. Don't over-analyze.

Conversing with the instructor of this class.

good	____:____:____:____:____:____:____	bad
weak	____:____:____:____:____:____:____	strong
heavy	____:____:____:____:____:____:____	light
fair	____:____:____:____:____:____:____	unfair
pleasant	____:____:____:____:____:____:____	unpleasant
slow	____:____:____:____:____:____:____	fast
hard	____:____:____:____:____:____:____	soft
simple	____:____:____:____:____:____:____	complex
dishonest	____:____:____:____:____:____:____	honest
sharp	____:____:____:____:____:____:____	dull
small	____:____:____:____:____:____:____	large
masculine	____:____:____:____:____:____:____	feminine
worthless	____:____:____:____:____:____:____	valuable
active	____:____:____:____:____:____:____	passive
anxious	____:____:____:____:____:____:____	confident

The computer/lab component of this course.

Remember:
Work quickly. Answer every question.
Record your immediate impressions.
Go with your feelings. Don't over-analyze.

light	____:____:____:____:____:____:____	heavy
honest	____:____:____:____:____:____:____	dishonest
dull	____:____:____:____:____:____:____	sharp
large	____:____:____:____:____:____:____	small
unpleasant	____:____:____:____:____:____:____	pleasant
valuable	____:____:____:____:____:____:____	worthless
soft	____:____:____:____:____:____:____	hard
unfair	____:____:____:____:____:____:____	fair
confident	____:____:____:____:____:____:____	anxious
passive	____:____:____:____:____:____:____	active
bad	____:____:____:____:____:____:____	good
strong	____:____:____:____:____:____:____	weak
feminine	____:____:____:____:____:____:____	masculine
fast	____:____:____:____:____:____:____	slow
complex	____:____:____:____:____:____:____	simple

E-mail as a communications tool.

dishonest	____:____:____:____:____:____:____	honest
anxious	____:____:____:____:____:____:____	confident
slow	____:____:____:____:____:____:____	fast
weak	____:____:____:____:____:____:____	strong
fair	____:____:____:____:____:____:____	unfair
heavy	____:____:____:____:____:____:____	light
pleasant	____:____:____:____:____:____:____	unpleasant
simple	____:____:____:____:____:____:____	complex
good	____:____:____:____:____:____:____	bad
hard	____:____:____:____:____:____:____	soft
small	____:____:____:____:____:____:____	large
masculine	____:____:____:____:____:____:____	feminine
active	____:____:____:____:____:____:____	passive
worthless	____:____:____:____:____:____:____	valuable
sharp	____:____:____:____:____:____:____	dull

In-class small-group discussions.

fast	____:____:____:____:____:____:____	slow
dull	____:____:____:____:____:____:____	sharp
unfair	____:____:____:____:____:____:____	fair
feminine	____:____:____:____:____:____:____	masculine
unpleasant	____:____:____:____:____:____:____	pleasant
complex	____:____:____:____:____:____:____	simple
bad	____:____:____:____:____:____:____	good
strong	____:____:____:____:____:____:____	weak
large	____:____:____:____:____:____:____	small
honest	____:____:____:____:____:____:____	dishonest
passive	____:____:____:____:____:____:____	active
light	____:____:____:____:____:____:____	heavy
soft	____:____:____:____:____:____:____	hard
confident	____:____:____:____:____:____:____	anxious
valuable	____:____:____:____:____:____:____	worthless

The lecture/classroom component of this course.

simple	____:____:____:____:____:____:____	complex
masculine	____:____:____:____:____:____:____	feminine
active	____:____:____:____:____:____:____	passive
small	____:____:____:____:____:____:____	large
sharp	____:____:____:____:____:____:____	dull
worthless	____:____:____:____:____:____:____	valuable
weak	____:____:____:____:____:____:____	strong
dishonest	____:____:____:____:____:____:____	honest
slow	____:____:____:____:____:____:____	fast
fair	____:____:____:____:____:____:____	unfair
hard	____:____:____:____:____:____:____	soft
heavy	____:____:____:____:____:____:____	light
pleasant	____:____:____:____:____:____:____	unpleasant
anxious	____:____:____:____:____:____:____	confident
good	____:____:____:____:____:____:____	bad

Oral presentations of my own work in a course.

dull	____:____:____:____:____:____:____	sharp
passive	____:____:____:____:____:____:____	active
light	____:____:____:____:____:____:____	heavy
unfair	____:____:____:____:____:____:____	fair
unpleasant	____:____:____:____:____:____:____	pleasant
valuable	____:____:____:____:____:____:____	worthless
bad	____:____:____:____:____:____:____	good
feminine	____:____:____:____:____:____:____	masculine
complex	____:____:____:____:____:____:____	simple
confident	____:____:____:____:____:____:____	anxious
large	____:____:____:____:____:____:____	small
honest	____:____:____:____:____:____:____	dishonest
fast	____:____:____:____:____:____:____	slow
strong	____:____:____:____:____:____:____	weak
soft	____:____:____:____:____:____:____	hard

Computers as an entertainment source.

anxious	____:____:____:____:____:____:____	confident
heavy	____:____:____:____:____:____:____	light
worthless	____:____:____:____:____:____:____	valuable
pleasant	____:____:____:____:____:____:____	unpleasant
fair	____:____:____:____:____:____:____	unfair
weak	____:____:____:____:____:____:____	strong
good	____:____:____:____:____:____:____	bad
sharp	____:____:____:____:____:____:____	dull
masculine	____:____:____:____:____:____:____	feminine
active	____:____:____:____:____:____:____	passive
small	____:____:____:____:____:____:____	large
dishonest	____:____:____:____:____:____:____	honest
hard	____:____:____:____:____:____:____	soft
simple	____:____:____:____:____:____:____	complex
slow	____:____:____:____:____:____:____	fast

Remember:
Work quickly. Answer every question.
Record your immediate impressions.
Go with your feelings. Don't over-analyze.

Writing term papers for a course.

soft	____:____:____:____:____:____:____	hard
confident	____:____:____:____:____:____:____	anxious
unpleasant	____:____:____:____:____:____:____	pleasant
feminine	____:____:____:____:____:____:____	masculine
honest	____:____:____:____:____:____:____	dishonest
large	____:____:____:____:____:____:____	small
dull	____:____:____:____:____:____:____	sharp
strong	____:____:____:____:____:____:____	weak
light	____:____:____:____:____:____:____	heavy
valuable	____:____:____:____:____:____:____	worthless
fast	____:____:____:____:____:____:____	slow
complex	____:____:____:____:____:____:____	simple
unfair	____:____:____:____:____:____:____	fair
passive	____:____:____:____:____:____:____	active
bad	____:____:____:____:____:____:____	good

The Internet as a source of information.

small	____:____:____:____:____:____:____	large
worthless	____:____:____:____:____:____:____	valuable
sharp	____:____:____:____:____:____:____	dull
anxious	____:____:____:____:____:____:____	confident
masculine	____:____:____:____:____:____:____	feminine
fair	____:____:____:____:____:____:____	unfair
dishonest	____:____:____:____:____:____:____	honest
good	____:____:____:____:____:____:____	bad
weak	____:____:____:____:____:____:____	strong
simple	____:____:____:____:____:____:____	complex
hard	____:____:____:____:____:____:____	soft
active	____:____:____:____:____:____:____	passive
pleasant	____:____:____:____:____:____:____	unpleasant
heavy	____:____:____:____:____:____:____	light
slow	____:____:____:____:____:____:____	fast

Remember:
Work quickly. Answer every question.
Record your immediate impressions.
Go with your feelings. Don't over-analyze.

Taking an examination in a course.

large	____:____:____:____:____:____:____	small
complex	____:____:____:____:____:____:____	simple
fast	____:____:____:____:____:____:____	slow
light	____:____:____:____:____:____:____	heavy
unpleasant	____:____:____:____:____:____:____	pleasant
soft	____:____:____:____:____:____:____	hard
dull	____:____:____:____:____:____:____	sharp
confident	____:____:____:____:____:____:____	anxious
valuable	____:____:____:____:____:____:____	worthless
passive	____:____:____:____:____:____:____	active
strong	____:____:____:____:____:____:____	weak
bad	____:____:____:____:____:____:____	good
feminine	____:____:____:____:____:____:____	masculine
honest	____:____:____:____:____:____:____	dishonest
unfair	____:____:____:____:____:____:____	fair

APPENDIX B

Survey Instrument
For Faculty Participants

(following pages)

NORTHWOOD UNIVERSITY SURVEY – FACULTY FORM

Thank you for agreeing to distribute this survey in your class.

THIS form is for you to fill out, place in the smaller envelope, and put in campus mail. (Keeping yours separate insures your anonymity.)

Please place the completed student surveys in the larger envelope and also send through campus mail. ASAP.

INSTRUCTIONS
Please fill out the above information, read the following instructions, and then proceed to the rest of the survey.

This survey is part of a study to measure what certain things mean to various people. On the following pages, a series of concepts appear in boxes, with rating scales to the right of each box. On the basis of what each concept means to you, please mark the accompanying scales.

Rate the concepts in order; don't skip ahead or go back.

Here is how you are to use the scales:
If you feel that the concept at the left is very closely related to one end of the scale, place your "X" as follows:

SOCIALISM fair _X_:___:___:___:___:___:___ unfair
or
fair ___:___:___:___:___:___:_X_ unfair

If you feel that the concept is quite closely related (but not extremely) to one or the other end of the scale, place your "X" as follows:

HAMMER strong ___:_X_:___:___:___:___:___ weak
or
strong ___:___:___:___:___:_X_:___ weak

If the concept seems only slightly related to one side as opposed to the other side (but is not really neutral), place your "X" as follows:

RADIO cold ___:___:_X_:___:___:___:___ hot
or
cold ___:___:___:___:_X_:___:___ hot

(The direction toward which you check, of course, depends upon which of the two ends of the scale seems most characteristic of the thing you're judging.)

If you consider the concept neutral on the scale, or feel both sides of the scale are equally associated with the concept, or consider the scale completely irrelevant or unrelated to the concept, place your "X" in the middle space:

PEOPLE cruel ___:___:___:_X_:___:___:___ kind

IMPORTANT: Place your "X" on the line, not on the boundary:

this ___:___:_X_ not this ___X___

Please work quickly (recording your first impressions), answer every question, and place only one mark per question.

Do not worry or puzzle over individual items. It is your first impressions, the immediate "feelings" about the items, that we want. On the other hand, please do not be careless, because we want your true impressions. Thank you.

Socializing with friends outside of class.

active	_____:_____:_____:_____:_____:_____:_____	passive
hard	_____:_____:_____:_____:_____:_____:_____	soft
worthless	_____:_____:_____:_____:_____:_____:_____	valuable
sharp	_____:_____:_____:_____:_____:_____:_____	dull
good	_____:_____:_____:_____:_____:_____:_____	bad
masculine	_____:_____:_____:_____:_____:_____:_____	feminine
small	_____:_____:_____:_____:_____:_____:_____	large
weak	_____:_____:_____:_____:_____:_____:_____	strong
simple	_____:_____:_____:_____:_____:_____:_____	complex
anxious	_____:_____:_____:_____:_____:_____:_____	confident
heavy	_____:_____:_____:_____:_____:_____:_____	light
slow	_____:_____:_____:_____:_____:_____:_____	fast
pleasant	_____:_____:_____:_____:_____:_____:_____	unpleasant
dishonest	_____:_____:_____:_____:_____:_____:_____	honest
fair	_____:_____:_____:_____:_____:_____:_____	unfair

Myself as a user of computers.

unfair	_____:_____:_____:_____:_____:_____:_____	fair
fast	_____:_____:_____:_____:_____:_____:_____	slow
large	_____:_____:_____:_____:_____:_____:_____	small
passive	_____:_____:_____:_____:_____:_____:_____	active
valuable	_____:_____:_____:_____:_____:_____:_____	worthless
unpleasant	_____:_____:_____:_____:_____:_____:_____	pleasant
soft	_____:_____:_____:_____:_____:_____:_____	hard
honest	_____:_____:_____:_____:_____:_____:_____	dishonest
confident	_____:_____:_____:_____:_____:_____:_____	anxious
dull	_____:_____:_____:_____:_____:_____:_____	sharp
strong	_____:_____:_____:_____:_____:_____:_____	weak
feminine	_____:_____:_____:_____:_____:_____:_____	masculine
bad	_____:_____:_____:_____:_____:_____:_____	good
light	_____:_____:_____:_____:_____:_____:_____	heavy
complex	_____:_____:_____:_____:_____:_____:_____	simple

Remember:
Work quickly. Answer every question.
Record your immediate impressions.
Go with your feelings. Don't over-analyze.

Conversing with students outside of class.

good	_____:_____:_____:_____:_____:_____:_____	bad
weak	_____:_____:_____:_____:_____:_____:_____	strong
heavy	_____:_____:_____:_____:_____:_____:_____	light
fair	_____:_____:_____:_____:_____:_____:_____	unfair
pleasant	_____:_____:_____:_____:_____:_____:_____	unpleasant
slow	_____:_____:_____:_____:_____:_____:_____	fast
hard	_____:_____:_____:_____:_____:_____:_____	soft
simple	_____:_____:_____:_____:_____:_____:_____	complex
dishonest	_____:_____:_____:_____:_____:_____:_____	honest
sharp	_____:_____:_____:_____:_____:_____:_____	dull
small	_____:_____:_____:_____:_____:_____:_____	large
masculine	_____:_____:_____:_____:_____:_____:_____	feminine
worthless	_____:_____:_____:_____:_____:_____:_____	valuable
active	_____:_____:_____:_____:_____:_____:_____	passive
anxious	_____:_____:_____:_____:_____:_____:_____	confident

The computer/lab component of this course.

light	____:____:____:____:____:____:____	heavy
honest	____:____:____:____:____:____:____	dishonest
dull	____:____:____:____:____:____:____	sharp
large	____:____:____:____:____:____:____	small
unpleasant	____:____:____:____:____:____:____	pleasant
valuable	____:____:____:____:____:____:____	worthless
soft	____:____:____:____:____:____:____	hard
unfair	____:____:____:____:____:____:____	fair
confident	____:____:____:____:____:____:____	anxious
passive	____:____:____:____:____:____:____	active
bad	____:____:____:____:____:____:____	good
strong	____:____:____:____:____:____:____	weak
feminine	____:____:____:____:____:____:____	masculine
fast	____:____:____:____:____:____:____	slow
complex	____:____:____:____:____:____:____	simple

Remember:
Work quickly. Answer every question.
Record your immediate impressions.
Go with your feelings. Don't over-analyze.

E-mail as a communications tool.

dishonest	____:____:____:____:____:____:____	honest
anxious	____:____:____:____:____:____:____	confident
slow	____:____:____:____:____:____:____	fast
weak	____:____:____:____:____:____:____	strong
fair	____:____:____:____:____:____:____	unfair
heavy	____:____:____:____:____:____:____	light
pleasant	____:____:____:____:____:____:____	unpleasant
simple	____:____:____:____:____:____:____	complex
good	____:____:____:____:____:____:____	bad
hard	____:____:____:____:____:____:____	soft
small	____:____:____:____:____:____:____	large
masculine	____:____:____:____:____:____:____	feminine
active	____:____:____:____:____:____:____	passive
worthless	____:____:____:____:____:____:____	valuable
sharp	____:____:____:____:____:____:____	dull

In-class small-group discussions.

fast	____:____:____:____:____:____:____	slow
dull	____:____:____:____:____:____:____	sharp
unfair	____:____:____:____:____:____:____	fair
feminine	____:____:____:____:____:____:____	masculine
unpleasant	____:____:____:____:____:____:____	pleasant
complex	____:____:____:____:____:____:____	simple
bad	____:____:____:____:____:____:____	good
strong	____:____:____:____:____:____:____	weak
large	____:____:____:____:____:____:____	small
honest	____:____:____:____:____:____:____	dishonest
passive	____:____:____:____:____:____:____	active
light	____:____:____:____:____:____:____	heavy
soft	____:____:____:____:____:____:____	hard
confident	____:____:____:____:____:____:____	anxious
valuable	____:____:____:____:____:____:____	worthless

The lecture/classroom component of this course.

simple	____:____:____:____:____:____:____	complex
masculine	____:____:____:____:____:____:____	feminine
active	____:____:____:____:____:____:____	passive
small	____:____:____:____:____:____:____	large
sharp	____:____:____:____:____:____:____	dull
worthless	____:____:____:____:____:____:____	valuable
weak	____:____:____:____:____:____:____	strong
dishonest	____:____:____:____:____:____:____	honest
slow	____:____:____:____:____:____:____	fast
fair	____:____:____:____:____:____:____	unfair
hard	____:____:____:____:____:____:____	soft
heavy	____:____:____:____:____:____:____	light
pleasant	____:____:____:____:____:____:____	unpleasant
anxious	____:____:____:____:____:____:____	confident
good	____:____:____:____:____:____:____	bad

Oral presentations of my own work in a course.

dull	____:____:____:____:____:____:____	sharp
passive	____:____:____:____:____:____:____	active
light	____:____:____:____:____:____:____	heavy
unfair	____:____:____:____:____:____:____	fair
unpleasant	____:____:____:____:____:____:____	pleasant
valuable	____:____:____:____:____:____:____	worthless
bad	____:____:____:____:____:____:____	good
feminine	____:____:____:____:____:____:____	masculine
complex	____:____:____:____:____:____:____	simple
confident	____:____:____:____:____:____:____	anxious
large	____:____:____:____:____:____:____	small
honest	____:____:____:____:____:____:____	dishonest
fast	____:____:____:____:____:____:____	slow
strong	____:____:____:____:____:____:____	weak
soft	____:____:____:____:____:____:____	hard

Computers as an entertainment source.

anxious	____:____:____:____:____:____:____	confident
heavy	____:____:____:____:____:____:____	light
worthless	____:____:____:____:____:____:____	valuable
pleasant	____:____:____:____:____:____:____	unpleasant
fair	____:____:____:____:____:____:____	unfair
weak	____:____:____:____:____:____:____	strong
good	____:____:____:____:____:____:____	bad
sharp	____:____:____:____:____:____:____	dull
masculine	____:____:____:____:____:____:____	feminine
active	____:____:____:____:____:____:____	passive
small	____:____:____:____:____:____:____	large
dishonest	____:____:____:____:____:____:____	honest
hard	____:____:____:____:____:____:____	soft
simple	____:____:____:____:____:____:____	complex
slow	____:____:____:____:____:____:____	fast

Remember:
Work quickly. Answer every question.
Record your immediate impressions.
Go with your feelings. Don't over-analyze.

Writing term papers for a course.

soft	____:____:____:____:____:____:____	hard
confident	____:____:____:____:____:____:____	anxious
unpleasant	____:____:____:____:____:____:____	pleasant
feminine	____:____:____:____:____:____:____	masculine
honest	____:____:____:____:____:____:____	dishonest
large	____:____:____:____:____:____:____	small
dull	____:____:____:____:____:____:____	sharp
strong	____:____:____:____:____:____:____	weak
light	____:____:____:____:____:____:____	heavy
valuable	____:____:____:____:____:____:____	worthless
fast	____:____:____:____:____:____:____	slow
complex	____:____:____:____:____:____:____	simple
unfair	____:____:____:____:____:____:____	fair
passive	____:____:____:____:____:____:____	active
bad	____:____:____:____:____:____:____	good

The Internet as a source of information.

small	____:____:____:____:____:____:____	large
worthless	____:____:____:____:____:____:____	valuable
sharp	____:____:____:____:____:____:____	dull
anxious	____:____:____:____:____:____:____	confident
masculine	____:____:____:____:____:____:____	feminine
fair	____:____:____:____:____:____:____	unfair
dishonest	____:____:____:____:____:____:____	honest
good	____:____:____:____:____:____:____	bad
weak	____:____:____:____:____:____:____	strong
simple	____:____:____:____:____:____:____	complex
hard	____:____:____:____:____:____:____	soft
active	____:____:____:____:____:____:____	passive
pleasant	____:____:____:____:____:____:____	unpleasant
heavy	____:____:____:____:____:____:____	light
slow	____:____:____:____:____:____:____	fast

Remember:
Work quickly. Answer every question.
Record your immediate impressions.
Go with your feelings. Don't over-analyze.

Taking an examination in a course.

large	____:____:____:____:____:____:____	small
complex	____:____:____:____:____:____:____	simple
fast	____:____:____:____:____:____:____	slow
light	____:____:____:____:____:____:____	heavy
unpleasant	____:____:____:____:____:____:____	pleasant
soft	____:____:____:____:____:____:____	hard
dull	____:____:____:____:____:____:____	sharp
confident	____:____:____:____:____:____:____	anxious
valuable	____:____:____:____:____:____:____	worthless
passive	____:____:____:____:____:____:____	active
strong	____:____:____:____:____:____:____	weak
bad	____:____:____:____:____:____:____	good
feminine	____:____:____:____:____:____:____	masculine
honest	____:____:____:____:____:____:____	dishonest
unfair	____:____:____:____:____:____:____	fair

APPENDIX C

Original Software for Survey Instrument:
Written to Randomize Sequence of 15 Scales
In All 12 of the Concepts

```
DEFINT A-Z
        DIM s(15), s$(15)
        s$( 1) = "good-bad"
        s$( 2) = "honest-dishonest"
        s$( 3) = "fair-unfair"
        s$( 4) = "pleasant-unpleasant"
        s$( 5) = "valuable-worthless"
        s$( 6) = "strong-weak"
        s$( 7) = "large-small"
        s$( 8) = "heavy-light"
        s$( 9) = "hard-soft"
        s$(10) = "fast-slow"
        s$(11) = "active-passive"
        s$(12) = "sharp-dull"
        s$(13) = "masculine-feminine"
        s$(14) = "anxious-confident"
        s$(15) = "simple-complex"

        FOR i = 1 TO 12
        FOR k = 1 TO 15: s(k) = 0: NEXT k
        FOR j = 1 TO 15
100 :   x = INT((15 - 1 + 1) * RND + 1)
        SELECT CASE s(x)
               CASE 0
                    s(x) = 1
                    LPRINT j; " "; s$(x); "  ";
               CASE 1
                    GOTO 100
               END SELECT
        NEXT j
        LPRINT : LPRINT : LPRINT
        NEXT i
        END
```

APPENDIX D

Reliability Test Results
Alpha and Split-Half
Semantic Differential Survey Instrument

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (A L P H A)

Reliability Coefficients

N of Cases = 186.0 N of Items =180

Alpha = .9555

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (S P L I T)

Reliability Coefficients

N of Cases = 186.0 N of Items =180

Correlation between forms = .6210 Equal-length Spearman-Brown = .7662

Guttman Split-half = .7638 Unequal-length Spearman-Brown = .7662

90 Items in part 1 90 Items in part 2

Alpha for part 1 = .9336 Alpha for part 2 = .9251

APPENDIX E

Original Software for Survey Instrument (QuickBasic, v4.5):
Written to Calculate D Values
For All 4 of the Issues, All 12 of the Concepts, All 15 of the Scales

```
      DEFINT A-Y
      DEFSNG Z

      pre$ = "C:\data\"

      c$ = CHR$(44): q$ = CHR$(34): null$ = ""
      DIM x(1 TO 180), y(1 TO 180), yd(1 TO 4), z(1 TO 132)
      DIM zm(1 TO 8, 1 TO 12, 1 TO 12), zall(1 TO 12, 1 TO 12)
      DIM zgen(1 TO 8, 1 TO 2, 1 TO 12, 1 TO 12)
      DIM zstud(1 TO 8, 1 TO 2, 1 TO 12, 1 TO 12)
      DIM a(1 TO 12, 1 TO 15), b(1 TO 12)
      DIM x$(1 TO 16)
      DIM k(1 TO 15), l(1 TO 15), zk(1 TO 6), zl(1 TO 6)
      DIM zi(1 TO 4, 1 TO 15), cx(1 TO 4, 1 TO 6)
      DIM stud(2), gen(2)
      DIM f$(1 TO 29)

      zt1 = TIMER
      CLS


'*******************************************************************
'
'       data files definition:
'       olddata.txt  =  raw data, converted to comma-delimited data
'                       from original Excel spreadsheet file
'       newdata.txt  =  converted raw data file (semantic differential
'                       scales re-oriented and put into uniform order)
'       facanal.txt  =  factor analysis data
'       d_all.txt    =  Osgood D values computed for all surveys
'       d_final.txt  =  Osgood D values computed, omitting surveys
'                       in which there are missing values
'
'*******************************************************************
      i = 1: GOSUB sub0
      OPEN f$(1) FOR INPUT AS #1
      FOR i = 2 TO 29
          GOSUB sub0
          OPEN f$(i) FOR APPEND AS #i
          CLOSE #i
          KILL f$(i)
          NEXT i
      FOR i = 2 TO 5
          OPEN f$(i) FOR APPEND AS #i
          NEXT i


'*******************************************************************
'
'       comparison variables:
'       a(i,j) = gives order and polar orientation of all 15 scales
```

```
'                in all 12 concepts
'       b(i) = gives order for 12 concepts
'       x$(i) = data headers
'
'*******************************************************************
      FOR i = 1 TO 12
          FOR j = 1 TO 15
          READ a(i, j)
          NEXT j, i
      FOR i = 1 TO 12: READ b(i): b(i) = (b(i) - 1) * 15:  NEXT i
      FOR i = 1 TO 5: READ x$(i): NEXT i


      zt2 = TIMER
      PRINT USING "###.##### seconds: "; zt2 - zt1;
      PRINT "Preparing files for data conversion"

      zt1 = TIMER
      counter = 0


'*******************************************************************
'
'        Printing data headers in files
'
'*******************************************************************
      '       FACANAL
      FOR i = 1 TO 15: READ x$: PRINT #3, q$; x$; q$;
          IF i < 15 THEN PRINT #3, c$; :  ELSE PRINT #3,
          NEXT i

      '       NEWDATA
      FOR i = 1 TO 5: PRINT #2, q$; x$(i); q$; c$; : NEXT i
      FOR i = 1 TO 180: READ x$: PRINT #2, q$; x$; q$;
          IF i < 180 THEN PRINT #2, c$; :  ELSE PRINT #2,
          NEXT i

      '       D_ALL and D_FINAL
      FOR i = 1 TO 5:
          PRINT #4, q$; x$(i); q$; c$;
          PRINT #5, q$; x$(i); q$; c$;
          NEXT i
      FOR i = 1 TO 66: READ x$
          PRINT #4, q$; x$; q$;
          PRINT #5, q$; x$; q$;
          IF i < 66 THEN PRINT #4, c$; :  ELSE PRINT #4,
          IF i < 66 THEN PRINT #5, c$; :  ELSE PRINT #5,
          NEXT i


'*******************************************************************
'
'       DO loop for reading in old data, converting it, and
'       saving it to the various new files
'
'*******************************************************************
      DO WHILE NOT EOF(1)
      ERASE x, y
      missing = 0
      counter = counter + 1
```

```
'*******************************************************************
'
'       The 5 demographic variables are stored in the first 5 columns
'       of the new files, with the exception of NEWFACAN.txt.
'       The 5 demographic variables are: student/faculty, gender,
'       course section code, academic class level, and grade student
'       expects to get in this course
'
'*******************************************************************

'*******************************************************************
'
'       input demographic and scale responses from old file
'
'*******************************************************************
      FOR i = 1 TO 4: INPUT #1, yd(i): NEXT i
      INPUT #1, z
      FOR i = 1 TO 180
          INPUT #1, y(i)
          IF y(i) = 0 THEN missing = 1
          NEXT i
      SELECT CASE missing
             CASE IS = 1
                 countmissing = countmissing + 1
             CASE IS = 0
                 stud(yd(1)) = stud(yd(1)) + 1
                 gen(yd(2)) = gen(yd(2)) + 1
             END SELECT


'*******************************************************************
'
'       print demographics to NEWDATA.txt
'
'*******************************************************************
      FOR p = 1 TO 4
          IF yd(p) > 0 THEN PRINT #2, yd(p);
          PRINT #2, c$;
          NEXT p
      IF z > 0 THEN PRINT #2, USING " #.#"; z;
      PRINT #2, c$;


'*******************************************************************
'
'       print demographics to new D_ALL.txt and D_FINAL.txt
'
'*******************************************************************
      FOR p = 1 TO 4
          IF yd(p) > 0 THEN PRINT #4, yd(p);
          PRINT #4, c$;
          NEXT p
      IF z > 0 THEN PRINT #4, USING " #.#"; z;
      PRINT #4, c$;

      IF missing = 0 THEN
                    FOR p = 1 TO 4
```

```
                  IF yd(p) > 0 THEN PRINT #5, yd(p);
                  PRINT #5, c$;
                  NEXT p
                IF z > 0 THEN PRINT #5, USING " #.#"; z;
                PRINT #5, c$;
                END IF


'*******************************************************************
'
'       Using the contents of a(12,15) and b(15) arrays,
'       (1) unifies the polarity of the semantic differential scales,
'       (2) unifies the order of scales inside each concept, and
'       (3) puts the concepts in the order found in Table 2.
'       k = concept number as found in the questionnaire
'       n = ordinal number of old data found in y(15) array
'
'*******************************************************************
      FOR i = 0 TO 165 STEP 15
         k = INT((i + 15) / 15)
         FOR j = 1 TO 15
           n = i + j
           SELECT CASE a(k, j)
              CASE IS < 0
                 x(b(k) - a(k, j)) = y(n)
              CASE IS > 0
                 x(b(k) + a(k, j)) = 8 - y(n)
                 IF y(n) = 0 THEN x(b(k) + a(k, j)) = 0
              END SELECT
           NEXT j


'*******************************************************************
'
'       writes each individual concept's 15 scales to FACANAL.txt
'       for later use in factor analysis
'
'*******************************************************************
         FOR p = b(k) + 1 TO b(k) + 14
           IF x(p) > 0 THEN
                    PRINT #3, x(p); c$;
                    ELSE PRINT #3, c$;
                    END IF
           NEXT p
         p = b(k) + 15
         IF x(p) > 0 THEN PRINT #3, x(p):  ELSE PRINT #3, null$

         NEXT i


'*******************************************************************
'
'       write newly ordered 180 data to new file 1
'
'*******************************************************************
      FOR p = 1 TO 179
         IF x(p) > 0 THEN PRINT #2, x(p); c$;  ELSE PRINT #2, c$;
         NEXT p
      IF x(180) > 0 THEN PRINT #2, x(180) ELSE PRINT #2, null$
```

```
'*******************************************************************
'
'       now that raw data are stored in NEWDATA.txt file, we can
'       substitute middle value "4" for missing data
'
'*******************************************************************
      FOR i = 1 TO 180
          IF x(i) = 0 THEN x(i) = 4
          NEXT i


'*******************************************************************
'
'       Calculating: Osgood D values on all 15 scales
'                    (c1 --> c2, c3, c4, ... c12; ... c11 --> c12)
'                    Level 1
'
'*******************************************************************
      level = 1
      counterz = 1
      FOR a = 1 TO 11
          ERASE k
          FOR i = 1 TO 15
             k(i) = x(((a - 1) * 15) + i)
             NEXT i
          FOR c = a + 1 TO 12
             j = ((c - 1) * 15) + 1
             ERASE l
             FOR i = j TO j + 14
                 l(i - j + 1) = x(i)
                 NEXT i
             cc = 0
             FOR ii = 1 TO 15
                 cc = cc + ((k(ii) - l(ii)) ^ 2)
                 NEXT ii
             GOSUB sub1zz
             GOSUB sub11
             GOSUB sub1
             zall(c, a) = zall(c, a) + zz
             counterz = counterz + 1
             NEXT c, a


'*******************************************************************
'
'       Calculating: Osgood D values on means of 6 factors
'                    (c1 --> c2, c3, c4, ... c12)
'                    Level 2
'
'*******************************************************************
      level = 2
      counterz = 1
      FOR a = 1 TO 11
          ERASE zk
          k = 0: FOR j = 1 TO 5: GOSUB sub2a: NEXT j: zk(1) = k / 5
          k = 0: FOR j = 6 TO 9: GOSUB sub2a: NEXT j: zk(2) = k / 4
          k = 0: FOR j = 10 TO 12: GOSUB sub2a: NEXT j: zk(3) = k / 3
          FOR i = 4 TO 6: zk(i) = x(((a - 1) * 15) + i + 9): NEXT i
          FOR c = a + 1 TO 12
```

```
            ERASE zl
            j = ((c - 1) * 15) + 1
            k = 0: FOR i = j TO j + 4: GOSUB sub2b: NEXT i
            zl(1) = k / 5
            k = 0: FOR i = j + 5 TO j + 8: GOSUB sub2b: NEXT i
            zl(2) = k / 4
            k = 0: FOR i = j + 9 TO j + 11: GOSUB sub2b: NEXT i
            zl(3) = k / 3
            FOR i = j + 12 TO j + 14: zl(i - j - 8) = x(i): NEXT i
            cc = 0
            FOR ii = 1 TO 6
                cc = cc + ((zk(ii) - zl(ii)) ^ 2)
                NEXT ii
            GOSUB sub1zz
            GOSUB sub1
            counterz = counterz + 1
            NEXT c, a


'*******************************************************************
'
'       Calculating: Osgood D values on all 15 scales for 4 Issues
'                    (i1 -> i2, i3, i4; i2 -> i3, i4; i3 -> i4)
'                    Level 3
'
'*******************************************************************
      level = 3
      ERASE zi
      FOR i = 1 TO 15
          zi(1, i) = x(i)
          x = 15: y = 75: u = 2: v = 5: GOSUB sub3a
          x = 90: y = 105: u = 3: v = 2: GOSUB sub3a
          x = 120: y = 165: u = 4: v = 4: GOSUB sub3a
          NEXT i
      x = 1
      y = 15
      GOSUB sub3b


'*******************************************************************
'
'       Calculating: Osgood D values on means of 6 factors for 4 Issues
'                    (i1 -> i2, i3, i4; i2 -> i3, i4; i3 -> i4)
'                    Level 4
'
'*******************************************************************
      level = 4
      ERASE zi, cx
      x = 0: y = 0: u = 1: GOSUB sub4a
      x = 1: y = 5: u = 2: GOSUB sub4a
      x = 6: y = 7: u = 3: GOSUB sub4a
      x = 8: y = 11: u = 4: GOSUB sub4a
      FOR i = 1 TO 4
          FOR j = 1 TO 6
            zi(i, j) = zi(i, j) / cx(i, j)
            NEXT j, i
      x = 1
      y = 6
      GOSUB sub3b
```

```
'*******************************************************************
'
'       Calculating: Osgood D values on Fem/Masc factor
'                    (c1 --> c2, c3, c4, ... c12)
'                    Level 5
'
'*******************************************************************
      level = 5
      x = 14
      FOR a = 1 TO 11
          FOR c = a + 1 TO 12
             GOSUB sub5a
             GOSUB sub1
             NEXT c, a


'*******************************************************************
'
'       Calculating: Osgood D values on Fem/Masc factor for 4 Issues
'                    (i1 -> i2, i3, i4; i2 -> i3, i4; i3 -> i4)
'                    Level 6
'
'*******************************************************************
      level = 6
      x = 5
      GOSUB sub6a


'*******************************************************************
'
'       Calculating: Osgood D values on Anxiety factor
'                    (c1 --> c2, c3, c4, ... c12)
'                    Level 7
'
'*******************************************************************
      level = 7
      x = 13
      FOR a = 1 TO 11
          FOR c = a + 1 TO 12
             GOSUB sub5a
             GOSUB sub1
             NEXT c, a


'*******************************************************************
'
'       Calculating: Osgood D values on Anxiety factor for 4 Issues
'                    (i1 -> i2, i3, i4; i2 -> i3, i4; i3 -> i4)
'                    Level 8
'
'*******************************************************************
      level = 8
      x = 4
      GOSUB sub6a


'*******************************************************************
'
'       printing data to D_ALL.txt and D_FINAL.txt
```

```
'
'****************************************************************
      FOR i = 1 TO 66
          PRINT #4, z(i);
          IF i = 66 THEN
                   PRINT #4,
                   ELSE PRINT #4, c$;
                   END IF
             NEXT i

      IF missing = 0 THEN
                    FOR i = 67 TO 132
                       PRINT #5, z(i);
                       IF i = 132 THEN
                                PRINT #5, null$
                                ELSE PRINT #5, c$;
                                END IF
                       NEXT i
                       END IF


'****************************************************************
'
'       END of process
'
'****************************************************************
      zt2 = TIMER
      LOCATE 2, 1
      PRINT USING "###.##### seconds"; zt2 - zt1;

      LOOP

      zt2 = TIMER
      LOCATE 2, 1
      xtimer$ = "###.##### seconds: Converting and storing data"
      PRINT USING xtimer$; zt2 - zt1
      zt1 = TIMER


      ERASE x$
      FOR i = 1 TO 16
          READ x$(i)
          NEXT i

      FOR level = 1 TO 8
          GOSUB sub9
          NEXT level


      zt2 = TIMER
      xtimer$ = "###.##### seconds: Storing Osgood D values"
      PRINT USING xtimer$; zt2 - zt1
      PRINT
      xtimer$ = "###"
      PRINT USING xtimer$; counter;
      PRINT " total surveys processed."
      PRINT USING xtimer$; countmissing;
      PRINT " surveys with missing data"
      PRINT USING xtimer$; counter - countmissing;
      PRINT " total usable surveys"
```

```
        PRINT
        PRINT USING xtimer$; gen(1);
        PRINT " females"
        PRINT USING xtimer$; gen(2);
        PRINT " males"
        PRINT
        PRINT USING xtimer$; stud(1);
        PRINT " students"
        PRINT USING xtimer$; stud(2);
        PRINT " faculty"

        CLOSE
        END


'*******************************************************************
'
'       Subroutines
'
'*******************************************************************

sub0:   READ f$(i): f$(i) = pre$ + f$(i): RETURN

sub1:   IF missing = 0 THEN
                     zm(level, c, a) = zm(level, c, a) + zz
                     IF yd(2) > 0 THEN GOSUB sub1a
                     IF yd(1) > 0 THEN GOSUB sub1b
                     END IF
        RETURN

sub1a:  zgen(level, yd(2), c, a) = zgen(level, yd(2), c, a) + zz
        RETURN

sub1b:  zstud(level, yd(1), c, a) = zstud(level, yd(1), c, a) + zz
        RETURN

sub11:  z(counterz) = zz
        SELECT CASE missing
               CASE IS = 0
                   z(counterz + 66) = zz
               CASE IS = 1
                   z(counterz + 66) = 9999
               END SELECT
        RETURN

sub1zz: IF cc > 0 THEN zz = SQR(cc):  ELSE zz = 0
        RETURN

sub2a:  i = ((a - 1) * 15) + j
sub2b:  k = k + x(i): RETURN


sub3a:  FOR cc = x TO y STEP 15
           zi(u, i) = zi(u, i) + x(cc + i)
           NEXT cc
        zi(u, i) = zi(u, i) / v
        RETURN

sub3b:  FOR a = 1 TO 3
```

```
            FOR c = a + 1 TO 4
               zc = 0
               FOR m = x TO y
                   zc = zc + ((zi(a, m) - zi(c, m)) ^ 2)
                   NEXT m
               GOSUB sub3zc
               GOSUB sub1
               NEXT c, a
        RETURN

sub3zc: IF zc > 0 THEN zz = SQR(zc):  ELSE zz = 0
        RETURN


sub4a:  FOR i = x TO y
            FOR j = 1 TO 15
               SELECT CASE j
                      CASE 1 TO 5: v = 1
                      CASE 6 TO 9: v = 2
                      CASE 10 TO 12: v = 3
                      CASE IS = 13: v = 4
                      CASE IS = 14: v = 5
                      CASE IS = 15: v = 6
                      END SELECT
               zi(u, v) = zi(u, v) + x((i * 15) + j)
               cx(u, v) = cx(u, v) + 1
               NEXT j, i
        RETURN

sub5a:  zz = ABS(x(((a - 1) * 15) + x) - x(((c - 1) * 15) + x))
        RETURN

sub6a:  FOR a = 1 TO 3
            FOR c = a + 1 TO 4
               zz = ABS(zi(a, x) - zi(c, x))
               GOSUB sub1
               NEXT c, a
        RETURN

sub9:   k = (level * 3) + 3
        FOR a = k TO k + 2: OPEN f$(a) FOR APPEND AS #a: NEXT a
        SELECT CASE level
               CASE 1, 2, 5, 7
                   m = 12
               CASE 3, 4, 6, 8
                   m = 4
               END SELECT
        x = (-1.5 * m) + 19
        FOR i = x TO x + m - 1
            c = k + 2
            IF level = 1 THEN a = k:  ELSE a = k + 1
            FOR j = a TO c
               PRINT #j, x$(i); c$;
               NEXT j, i
        FOR i = x TO x + m - 1
            FOR j = k TO k + 2
               PRINT #j, x$(i);
               IF i < (x + m - 1) THEN
                                PRINT #j, c$;
                                ELSE PRINT #j, null$
```

```
                        END IF
            NEXT j, i
        FOR a = 1 TO m
            FOR c = 1 TO m
               x = counter - countmissing
               SELECT CASE (a - c)
                      CASE IS = 0
                          PRINT #k, 0;
                          PRINT #(k + 1), 0;
                          PRINT #(k + 2), 0;
                      CASE IS < 0
                          PRINT #k, null$;
                          PRINT #(k + 1), null$;
                          PRINT #(k + 2), null$;
                      CASE IS > 0
                          PRINT #k, zm(level, a, c) / x;
                          PRINT #(k + 1), zgen(level, 1, a, c) / gen(1);
                          PRINT #(k + 2), zstud(level, 1, a, c) / stud(1);
                      END SELECT
               IF c < 12 THEN PRINT #k, c$;
               PRINT #(k + 1), c$;
               PRINT #(k + 2), c$;
               NEXT c
            IF level = 1 THEN PRINT #k, c$;
            FOR c = 1 TO m
               SELECT CASE (a - c)
                      CASE IS = 0
                          IF level = 1 THEN PRINT #k, 0;
                          PRINT #(k + 1), 0;
                          PRINT #(k + 2), 0;
                      CASE IS < 0
                          IF level = 1 THEN PRINT #k, null$;
                          PRINT #(k + 1), null$;
                          PRINT #(k + 2), null$;
                      CASE IS > 0
                          IF level = 1 THEN PRINT #k, zall(a, c) / counter;
                          PRINT #(k + 1), zgen(level, 2, a, c) / gen(2);
                          PRINT #(k + 2), zstud(level, 2, a, c) / stud(2);
                      END SELECT
               IF c < 12 THEN
                        IF level = 1 THEN PRINT #k, c$;
                        PRINT #(k + 1), c$;
                        PRINT #(k + 2), c$;
                        END IF
               NEXT c
            PRINT #k, null$
            PRINT #(k + 1), null$
            PRINT #(k + 2), null$
            NEXT a
        FOR a = k TO k + 2: CLOSE #a: NEXT a
        RETURN


'******************************************************************
'
'       File names
'
'******************************************************************
```

```
      DATA "olddata.txt"      : REM  1
      DATA "newdata.txt"      : REM  2
      DATA "facanal.txt"      : REM  3
      DATA "d_all.txt"        : REM  4
      DATA "d_final.txt"      : REM  5
      DATA "ms01all.txt"      : REM  6
      DATA "ms01gen.txt"      : REM  7
      DATA "ms01stud.txt"     : REM  8
      DATA "ms02all.txt"      : REM  9
      DATA "ms02gen.txt"      : REM 10
      DATA "ms02stud.txt"     : REM 11
      DATA "ms03all.txt"      : REM 12
      DATA "ms03gen.txt"      : REM 13
      DATA "ms03stud.txt"     : REM 14
      DATA "ms04all.txt"      : REM 15
      DATA "ms04gen.txt"      : REM 16
      DATA "ms04stud.txt"     : REM 17
      DATA "ms05all.txt"      : REM 18
      DATA "ms05gen.txt"      : REM 19
      DATA "ms05stud.txt"     : REM 20
      DATA "ms06all.txt"      : REM 21
      DATA "ms06gen.txt"      : REM 22
      DATA "ms06stud.txt"     : REM 23
      DATA "ms07all.txt"      : REM 24
      DATA "ms07gen.txt"      : REM 25
      DATA "ms07stud.txt"     : REM 26
      DATA "ms08all.txt"      : REM 27
      DATA "ms08gen.txt"      : REM 28
      DATA "ms08stud.txt"     : REM 29


'**************************************************************
'
'       Data for a(12,15) and b(15)
'
'**************************************************************
      DATA 11,9,-5,12,1,-14,-7,-6,15,-13,8,-10,4,-2,3:  REM  1
      DATA -3,10,7,-11,5,-4,-9,2,13,-12,6,14,-1,-8,-15: REM  2
      DATA 1,-6,8,3,4,-10,9,15,-2,12,-7,-14,-5,11,-13:  REM  3
      DATA -8,2,-12,7,-4,5,-9,-3,13,-11,-1,6,14,10,-15: REM  4
      DATA -2,-13,-10,-6,3,8,4,15,1,9,-7,-14,11,-5,12:  REM  5
      DATA 10,-12,-3,14,-4,-15,-1,6,7,2,-11,-8,-9,13,5: REM  6
      DATA 15,-14,11,-7,12,-5,-6,-2,-10,3,9,8,4,-13,1:  REM  7
      DATA -12,-11,-8,-3,-4,5,-1,14,-15,13,7,2,10,6,-9: REM  8
      DATA -13,8,-5,4,3,-6,1,12,-14,11,-7,-2,9,15,-10:  REM  9
      DATA -9,13,-4,14,2,7,-12,6,-8,5,10,-15,-3,-11,-1: REM 10
      DATA -7,-5,12,-13,-14,3,-2,1,-6,15,9,11,4,8,-10:  REM 11
      DATA 7,-15,10,-8,-4,-9,-12,13,5,-11,6,-1,14,2,-3: REM 12
      DATA 7,9,8,1,10,2,3,4,11,5,12,6: REM ordering concepts

'**************************************************************
'
'       Data for x$(5) - headers for demographics
'
'**************************************************************
      DATA "s_or_f","gender","section","class","grade"

'**************************************************************
'
'       Data for headers for NEWFACAN.txt
```

```
'
'****************************************************************
      DATA "good1","honest1","fair1","pleasan1","valuabl1"
      DATA "strong2","large2","heavy2","hard2"
      DATA "fast3","active3","sharp3"
      DATA "confide4","feminin5","simple6"


'****************************************************************
'
'       Data for headers for NEWDATA.txt
'
'****************************************************************
      DATA "c01s01","c01s02","c01s03","c01s04","c01s05","c01s06"
      DATA "c01s07","c01s08","c01s09","c01s10","c01s11","c01s12"
      DATA "c01s13","c01s14","c01s15","c02s01","c02s02","c02s03"
      DATA "c02s04","c02s05","c02s06","c02s07","c02s08","c02s09"
      DATA "c02s10","c02s11","c02s12","c02s13","c02s14","c02s15"
      DATA "c03s01","c03s02","c03s03","c03s04","c03s05","c03s06"
      DATA "c03s07","c03s08","c03s09","c03s10","c03s11","c03s12"
      DATA "c03s13","c03s14","c03s15","c04s01","c04s02","c04s03"
      DATA "c04s04","c04s05","c04s06","c04s07","c04s08","c04s09"
      DATA "c04s10","c04s11","c04s12","c04s13","c04s14","c04s15"
      DATA "c05s01","c05s02","c05s03","c05s04","c05s05","c05s06"
      DATA "c05s07","c05s08","c05s09","c05s10","c05s11","c05s12"
      DATA "c05s13","c05s14","c05s15","c06s01","c06s02","c06s03"
      DATA "c06s04","c06s05","c06s06","c06s07","c06s08","c06s09"
      DATA "c06s10","c06s11","c06s12","c06s13","c06s14","c06s15"
      DATA "c07s01","c07s02","c07s03","c07s04","c07s05","c07s06"
      DATA "c07s07","c07s08","c07s09","c07s10","c07s11","c07s12"
      DATA "c07s13","c07s14","c07s15","c08s01","c08s02","c08s03"
      DATA "c08s04","c08s05","c08s06","c08s07","c08s08","c08s09"
      DATA "c08s10","c08s11","c08s12","c08s13","c08s14","c08s15"
      DATA "c09s01","c09s02","c09s03","c09s04","c09s05","c09s06"
      DATA "c09s07","c09s08","c09s09","c09s10","c09s11","c09s12"
      DATA "c09s13","c09s14","c09s15","c10s01","c10s02","c10s03"
      DATA "c10s04","c10s05","c10s06","c10s07","c10s08","c10s09"
      DATA "c10s10","c10s11","c10s12","c10s13","c10s14","c10s15"
      DATA "c11s01","c11s02","c11s03","c11s04","c11s05","c11s06"
      DATA "c11s07","c11s08","c11s09","c11s10","c11s11","c11s12"
      DATA "c11s13","c11s14","c11s15","c12s01","c12s02","c12s03"
      DATA "c12s04","c12s05","c12s06","c12s07","c12s08","c12s09"
      DATA "c12s10","c12s11","c12s12","c12s13","c12s14","c12s15"

'****************************************************************
'
'       Data for headers for dll.txt and d_final.txt
'
'****************************************************************
      DATA "d01_02","d01_03","d01_04","d01_05","d01_06"
      DATA "d01_07","d01_08","d01_09","d01_10","d01_11"
      DATA "d01_12","d02_03","d02_04","d02_05","d02_06"
      DATA "d02_07","d02_08","d02_09","d02_10","d02_11"
      DATA "d02_12","d03_04","d03_05","d03_06","d03_07"
      DATA "d03_08","d03_09","d03_10","d03_11","d03_12"
      DATA "d04_05","d04_06","d04_07","d04_08","d04_09"
      DATA "d04_10","d04_11","d04_12","d05_06","d05_07"
      DATA "d05_08","d05_09","d05_10","d05_11","d05_12"
      DATA "d06_07","d06_08","d06_09","d06_10","d06_11"
      DATA "d06_12","d07_08","d07_09","d07_10","d07_11"
```

```
      DATA "d07_12","d08_09","d08_10","d08_11","d08_12"
      DATA "d09_10","d09_11","d09_12","d10_11","d10_12"
      DATA "d11_12"

'******************************************************************
'
'       Data headers for all Multidimensional Scaling files
'
'******************************************************************
      DATA "cmi"
      DATA "clasdisc","claslec","clasoral","claswrit","clasexam"
      DATA "afriends","ainstruc"
      DATA "comyself","comemail","comIent","comIinf"
      DATA "cmi","class","affect","computer"
```

APPENDIX F

Validation of Original Software for Survey Instrument (QuickBasic, v4.5)
Results of Dummy Data:
Hand Calculated vs. Calculated by Software

Dummy data:	Results from program:
11,9,5,12,701,14,7,6,15,13,8,10,4,2,3	101,2,3,4,5,6,7,8,9,10,11,12,13,14,15
3,10,7,11,5,4,9,2,13,12,6,14,901,8,15	201,2,3,4,5,6,7,8,9,10,11,12,13,14,15
801,6,8,3,4,10,9,15,2,12,7,14,5,11,13	301,2,3,4,5,6,7,8,9,10,11,12,13,14,15
8,2,12,7,4,5,9,3,13,11,101,6,14,10,15	401,2,3,4,5,6,7,8,9,10,11,12,13,14,15
2,13,10,6,3,8,4,15,1001,9,7,14,11,5,12	501,2,3,4,5,6,7,8,9,10,11,12,13,14,15
10,12,3,14,4,15,201,6,7,2,11,8,9,13,5	601,2,3,4,5,6,7,8,9,10,11,12,13,14,15
15,14,11,7,12,5,6,2,10,3,9,8,4,13,301	701,2,3,4,5,6,7,8,9,10,11,12,13,14,15
12,11,8,3,4,5,401,14,15,13,7,2,10,6,9	801,2,3,4,5,6,7,8,9,10,11,12,13,14,15
13,8,5,4,3,6,1101,12,14,11,7,2,9,15,10	901,2,3,4,5,6,7,8,9,10,11,12,13,14,15
9,13,4,14,2,7,12,6,8,5,10,15,3,11,501	1001,2,3,4,5,6,7,8,9,10,11,12,13,14,15
7,5,12,13,14,3,2,1201,6,15,9,11,4,8,10	1101,2,3,4,5,6,7,8,9,10,11,12,13,14,15
7,15,10,8,4,9,12,13,5,11,6,601,14,2,3	1201,2,3,4,5,6,7,8,9,10,11,12,13,14,15

Dummy data:	Results from program:
7,7,1,7,7,1,1,1,7,1,7,1,7,1,7	1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
1,7,7,1,7,1,1,7,7,1,7,7,1,1,1	1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
7,1,7,7,7,1,7,7,1,7,1,1,1,7,1	1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
1,7,1,7,1,7,1,1,7,1,1,7,7,7,1	1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
1,1,1,1,7,7,7,7,7,7,1,1,7,1,7	1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
7,1,1,7,1,1,1,7,7,7,1,1,1,7,7	1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
7,1,7,1,7,1,1,1,1,7,7,7,7,1,7	1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
1,1,1,1,1,7,1,7,1,7,7,7,7,7,1	1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
1,7,1,7,7,1,7,7,1,7,1,1,7,7,1	1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
1,7,1,7,7,7,1,7,1,7,7,1,1,1,1	1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
1,1,7,1,1,7,1,7,1,7,7,7,7,7,1	1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
7,1,7,1,1,1,1,7,7,1,7,1,7,7,1	1,1,1,1,1,1,1,1,1,1,1,1,1,1,1

Calculating: Osgood D values on all 15 scales
(c1 → c2, c3, c4, … c12)

Dummy data:	Calculations by hand:	Results from program:
4,4,4,4,4,4,4,4,4,4,4,4,4,4,4	11.61895004	11.61895003862225
1,1,1,1,1,1,1,1,1,1,1,1,1,1,1	7.74596692	7.745966692414834
2,2,2,2,2,2,2,2,2,2,2,2,2,2,2	3.872983346	3.872983346207417
3,3,3,3,3,3,3,3,3,3,3,3,3,3,3	3.872983346	3.872983346207417
5,5,5,5,5,5,5,5,5,5,5,5,5,5,5	7.74596692	7.745966692414834
6,6,6,6,6,6,6,6,6,6,6,6,6,6,6	11.61895004	11.61895003862225
7,7,7,7,7,7,7,7,7,7,7,7,7,7,7	11.22497216	11.22497216032182
1,7,1,7,1,7,1,7,1,7,1,7,1,7,4	7.483314774	7.483314773547883
2,6,2,6,2,6,2,6,2,6,2,6,2,6,4	3.741657387	3.741657386773941
3,5,3,5,3,5,3,5,3,5,3,5,3,5,4	0	0
4,4,4,4,4,4,4,4,4,4,4,4,4,4,4	7.615773106	7.615773105863909
1,2,3,5,6,7,1,2,3,5,6,7,3,5,4		

Calculating: Osgood D values on means of 6 factors
(c1 → c2, c3, c4, … c12)

Dummy data:	Calculations by hand:	Results from program:
4,4,4,4,4,4,4,4,4,4,4,4,4,4,4	7.3484692	7.348469228349535
7,7,7,7,7,7,7,7,7,7,7,7,7,7,7	4.8989794	4.898979485566356
6,6,6,6,6,6,6,6,6,6,6,6,6,6,6	2.4494897	2.449489742783178

5,5,5,5,5,5,5,5,5,5,5,5,5,5,5	2.4494897	2.449489742783178
3,3,3,3,3,3,3,3,3,3,3,3,3,3,3	4.8989794	4.898979485566356
2,2,2,2,2,2,2,2,2,2,2,2,2,2,2	7.3484692	7.348469228349535
7,7,7,7,7,1,1,1,1,7,7,7,1,7,1	4.8989794	4.898979485566356
6,7,5,5,7,2,1,3,2,2,1,3,6,2,6	2.4494897	2.449489742783178
5,6,5,4,5,3,3,4,2,5,6,4,3,5,3	2.4494897	2.449489742783178
7,6,5,4,3,1,5,2,4,3,5,7,5,3,5	0	0
2,3,4,5,6,4,1,4,7,2,4,6,4,4,4	4.8989794	4.898979485566356
6,5,6,7,6,6,5,7,6,2,3,1,2,6,2		

Calculating: Osgood D values on all 15 scales for 4 Issues
(I1 -> I2, I3, I4; I2 -> I3, I4; I3 -> I4)

Dummy data:	Calculations by hand:	Results from program:
4,4,4,4,4,4,4,4,4,4,4,4,4,4,4		
3,3,4,1,3,3,1,4,3,3,3,3,4,1,3	3.8729833	3.872983346207417
3,3,2,5,1,1,5,2,3,3,3,3,2,5,1	7.7459666	7.745966692414834
3,3,4,4,3,3,4,4,3,3,3,3,4,4,3	0	0
3,4,2,2,5,5,2,2,4,3,3,4,2,2,5	3.8729833	3.872983346207417
3,2,3,3,3,3,3,3,2,3,3,2,3,3,3	3.8729833	3.872983346207417
2,3,1,2,3,3,2,1,3,2,2,3,1,2,3	7.7459666	7.745966692414834
2,1,3,2,1,1,2,3,1,2,2,1,3,2,1		
4,3,2,7,2,2,7,2,3,4,4,3,2,7,2		
4,5,2,1,6,6,1,2,5,4,4,5,2,1,6		
4,3,6,1,7,7,1,6,3,4,4,3,6,1,7		
4,5,6,7,1,1,7,6,5,4,4,5,6,7,1		

Calculating: Osgood D values on means of 6 factors for 4 Issues
(I1 -> I2, I3, I4; I2 -> I3, I4; I3 -> I4)

Dummy data:	Calculations by hand:	Results from program:
4,4,4,4,4,4,4,4,4,4,4,4,4,4,4		
3,3,2,1,3,3,1,2,3,2,2,2,3,3,2	2.4494897	2.449489742783178
1,3,2,1,2,2,3,2,1,1,1,1,2,3,3	4.8989794	4.898979485566356
3,2,1,3,1,1,2,3,1,3,3,3,1,3,3	0	0
2,2,2,2,3,1,2,1,3,1,1,1,3,3,3	2.4494897	2.449489742783178
3,1,1,3,1,3,3,3,2,2,2,2,3,3,1	2.4494897	2.449489742783178
2,6,3,2,5,1,4,2,3,4,4,4,1,2,3	4.8989794	4.898979485566356
4,6,5,3,4,7,4,6,5,4,4,4,7,6,5		
6,5,7,7,6,6,5,6,6,6,5,6,6,5,6		
5,6,5,7,5,6,7,5,5,6,7,5,6,7,5		
7,6,6,5,6,6,5,7,7,6,5,7,6,5,7		
5,6,7,6,7,6,7,6,6,6,7,6,6,7,6		

Calculating: Osgood D values on Fem/Masc factor
(c1 --> c2, c3, c4, ... c12)

Dummy data:	Calculations by hand:	Results from program:
1,1,1,1,1,1,1,1,1,1,1,1,1,1,1		
1,1,1,1,1,1,1,1,1,1,1,1,1,2,1	1	1
1,1,1,1,1,1,1,1,1,1,1,1,1,3,1	2	2
1,1,1,1,1,1,1,1,1,1,1,1,1,4,1	3	3
1,1,1,1,1,1,1,1,1,1,1,1,1,5,1	4	4
1,1,1,1,1,1,1,1,1,1,1,1,1,6,1	5	5
1,1,1,1,1,1,1,1,1,1,1,1,1,7,1	6	6
1,1,1,1,1,1,1,1,1,1,1,1,1,6,1	5	5
1,1,1,1,1,1,1,1,1,1,1,1,1,5,1	4	4
1,1,1,1,1,1,1,1,1,1,1,1,1,4,1	3	3
1,1,1,1,1,1,1,1,1,1,1,1,1,3,1	2	2
1,1,1,1,1,1,1,1,1,1,1,1,1,2,1	1	1

Calculating: Osgood D values on Fem/Masc factor for 4 Issues
(i1 -> i2, i3, i4; i2 -> i3, i4; i3 -> i4)

Dummy data:	Calculations by hand:	Results from program:
1,1,1,1,1,1,1,1,1,1,1,1,1,1,1		
1,1,1,1,1,1,1,1,1,1,1,1,1,2,1	1	1
1,1,1,1,1,1,1,1,1,1,1,1,1,2,1	2	2
1,1,1,1,1,1,1,1,1,1,1,1,1,2,1	3	3

1,1,1,1,1,1,1,1,1,1,1,1,1,2,1	1	1
1,1,1,1,1,1,1,1,1,1,1,1,1,2,1	2	2
1,1,1,1,1,1,1,1,1,1,1,1,1,3,1	1	1
1,1,1,1,1,1,1,1,1,1,1,1,1,3,1		
1,1,1,1,1,1,1,1,1,1,1,1,1,4,1		
1,1,1,1,1,1,1,1,1,1,1,1,1,4,1		
1,1,1,1,1,1,1,1,1,1,1,1,1,4,1		
1,1,1,1,1,1,1,1,1,1,1,1,1,4,1		
Calculating: Osgood D values on Anxiety factor (c1 --> c2, c3, c4, ... c12)		
Dummy data:	Calculations by hand:	Results from program:
1,1,1,1,1,1,1,1,1,1,1,1,1,1,1		
1,1,1,1,1,1,1,1,1,1,1,1,2,1,1	1	1
1,1,1,1,1,1,1,1,1,1,1,1,3,1,1	2	2
1,1,1,1,1,1,1,1,1,1,1,1,4,1,1	3	3
1,1,1,1,1,1,1,1,1,1,1,1,5,1,1	4	4
1,1,1,1,1,1,1,1,1,1,1,1,6,1,1	5	5
1,1,1,1,1,1,1,1,1,1,1,1,7,1,1	6	6
1,1,1,1,1,1,1,1,1,1,1,1,6,1,1	5	5
1,1,1,1,1,1,1,1,1,1,1,1,5,1,1	4	4
1,1,1,1,1,1,1,1,1,1,1,1,4,1,1	3	3
1,1,1,1,1,1,1,1,1,1,1,1,3,1,1	2	2
1,1,1,1,1,1,1,1,1,1,1,1,2,1,1	1	1
Calculating: Osgood D values on Anxiety factor for 4 Issues (i1 -> i2, i3, i4; i2 -> i3, i4; i3 -> i4)		
Dummy data:	Calculations by hand:	Results from program:
1,1,1,1,1,1,1,1,1,1,1,1,1,1,1	1	1
1,1,1,1,1,1,1,1,1,1,1,1,2,1,1	2	2
1,1,1,1,1,1,1,1,1,1,1,1,2,1,1	3	3
1,1,1,1,1,1,1,1,1,1,1,1,2,1,1	1	1
1,1,1,1,1,1,1,1,1,1,1,1,2,1,1	2	2
1,1,1,1,1,1,1,1,1,1,1,1,2,1,1	1	1
1,1,1,1,1,1,1,1,1,1,1,1,3,1,1		
1,1,1,1,1,1,1,1,1,1,1,1,3,1,1		
1,1,1,1,1,1,1,1,1,1,1,1,4,1,1		
1,1,1,1,1,1,1,1,1,1,1,1,4,1,1		
1,1,1,1,1,1,1,1,1,1,1,1,4,1,1		
1,1,1,1,1,1,1,1,1,1,1,1,4,1,1		

APPENDIX G

Mann-Whitney/Wilcoxon Test: Populations of D Values
All Surveys Returned ("all", n=237)
vs. Only Those With No Missing Values ("whole", n=186)

		Mean Rank	Sum of Ranks	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
D01_02	all	216.764	51373.0				
	whole	205.930	38303.0				
	Total			20912.0	38303.0	-0.9047	0.3656
D01_03	all	214.517	50840.5				
	whole	208.793	38835.5				
	Total			21444.5	38835.5	-0.4780	0.6326
D01_04	all	217.793	51617.0				
	whole	204.618	38059.0				
	Total			20668.0	38059.0	-1.1003	0.2712
D01_05	all	214.230	50772.5				
	whole	209.159	38903.5				
	Total			21512.5	38903.5	-0.4235	0.6719
D01_06	all	213.133	50512.5				
	whole	210.556	39163.5				
	Total			21772.5	39163.5	-0.2152	0.8296
D01_07	all	214.283	50785.0				
	whole	209.091	38891.0				
	Total			21500.0	38891.0	-0.4335	0.6646
D01_08	all	214.679	50879.0				
	whole	208.586	38797.0				
	Total			21406.0	38797.0	-0.5089	0.6108
D01_09	all	214.534	50844.5				
	whole	208.771	38831.5				
	Total			21440.5	38831.5	-0.4812	0.6303
D01_10	all	213.848	50682.0				
	whole	209.645	38994.0				
	Total			21603.0	38994.0	-0.3510	0.7256
D01_11	all	211.795	50195.5				
	whole	212.261	39480.5				
	Total			21992.5	50195.5	-0.0389	0.9690
D01_12	all	214.198	50765.0				
	whole	209.199	38911.0				
	Total			21520.0	38911.0	-0.4175	0.6763
D02_03	all	215.570	51090.0				
	whole	207.452	38586.0				
	Total			21195.0	38586.0	-0.6779	0.4978
D02_04	all	217.245	51487.0				
	whole	205.317	38189.0				
	Total			20798.0	38189.0	-0.9961	0.3192
D02_05	all	213.762	50661.5				
	whole	209.755	39014.5				
	Total			21623.5	39014.5	-0.3346	0.7380
D02_06	all	213.217	50532.5				
	whole	210.449	39143.5				
	Total			21752.5	39143.5	-0.2312	0.8172

D02_07	all	215.287	51023.0				
	whole	207.812	38653.0				
	Total			21262.0	38653.0	-0.6243	0.5324
D02_08	all	215.808	51146.5				
	whole	207.148	38529.5				
	Total			21138.5	38529.5	-0.7233	0.4695
D02_09	all	215.249	51014.0				
	whole	207.860	38662.0				
	Total			21271.0	38662.0	-0.6170	0.5372
D02_10	all	216.057	51205.5				
	whole	206.831	38470.5				
	Total			21079.5	38470.5	-0.7705	0.4410
D02_11	all	214.884	50927.5				
	whole	208.325	38748.5				
	Total			21357.5	38748.5	-0.5477	0.5839
D02_12	all	213.627	50629.5				
	whole	209.927	39046.5				
	Total			21655.5	39046.5	-0.3089	0.7574
D03_04	all	215.572	51090.5				
	whole	207.449	38585.5				
	Total			21194.5	38585.5	-0.6784	0.4975
D03_05	all	213.352	50564.5				
	whole	210.277	39111.5				
	Total			21720.5	39111.5	-0.2568	0.7973
D03_06	all	212.795	50432.5				
	whole	210.987	39243.5				
	Total			21852.5	39243.5	-0.1511	0.8799
D03_07	all	215.118	50983.0				
	whole	208.027	38693.0				
	Total			21302.0	38693.0	-0.5922	0.5537
D03_08	all	214.890	50929.0				
	whole	208.317	38747.0				
	Total			21356.0	38747.0	-0.5490	0.5830
D03_09	all	212.795	50432.5				
	whole	210.987	39243.5				
	Total			21852.5	39243.5	-0.1511	0.8799
D03_10	all	211.916	50224.0				
	whole	212.108	39452.0				
	Total			22021.0	50224.0	-0.0160	0.9872
D03_11	all	212.669	50402.5				
	whole	211.148	39273.5				
	Total			21882.5	39273.5	-0.1270	0.8989
D03_12	all	213.390	50573.5				
	whole	210.229	39102.5				
	Total			21711.5	39102.5	-0.2640	0.7917
D04_05	all	216.316	51267.0				
	whole	206.500	38409.0				
	Total			21018.0	38409.0	-0.8198	0.4123
D04_06	all	214.970	50948.0				
	whole	208.215	38728.0				
	Total			21337.0	38728.0	-0.5642	0.5726
D04_07	all	216.616	51338.0				
	whole	206.118	38338.0				
	Total			20947.0	38338.0	-0.8767	0.3806

D04_08	all	215.605	51098.5				
	whole	207.406	38577.5				
	Total			21186.5	38577.5	-0.6848	0.4935
D04_09	all	216.595	51333.0				
	whole	206.145	38343.0				
	Total			20952.0	38343.0	-0.8727	0.3828
D04_10	all	213.241	50538.0				
	whole	210.419	39138.0				
	Total			21747.0	39138.0	-0.2356	0.8137
D04_11	all	214.475	50830.5				
	whole	208.847	38845.5				
	Total			21454.5	38845.5	-0.4700	0.6384
D04_12	all	215.093	50977.0				
	whole	208.059	38699.0				
	Total			21308.0	38699.0	-0.5874	0.5569
D05_06	all	213.838	50679.5				
	whole	209.659	38996.5				
	Total			21605.5	38996.5	-0.3490	0.7271
D05_07	all	212.124	50273.5				
	whole	211.841	39402.5				
	Total			22011.5	39402.5	-0.0236	0.9811
D05_08	all	212.825	50439.5				
	whole	210.949	39236.5				
	Total			21845.5	39236.5	-0.1567	0.8755
D05_09	all	214.148	50753.0				
	whole	209.263	38923.0				
	Total			21532.0	38923.0	-0.4079	0.6834
D05_10	all	212.686	50406.5				
	whole	211.126	39269.5				
	Total			21878.5	39269.5	-0.1302	0.8964
D05_11	all	213.698	50646.5				
	whole	209.836	39029.5				
	Total			21638.5	39029.5	-0.3225	0.7470
D05_12	all	212.146	50278.5				
	whole	211.815	39397.5				
	Total			22006.5	39397.5	-0.0276	0.9779
D06_07	all	212.568	50378.5				
	whole	211.277	39297.5				
	Total			21906.5	39297.5	-0.1078	0.9142
D06_08	all	211.546	50136.5				
	whole	212.578	39539.5				
	Total			21933.5	50136.5	-0.0861	0.9314
D06_09	all	211.129	50037.5				
	whole	213.110	39638.5				
	Total			21834.5	50037.5	-0.1655	0.8686
D06_10	all	210.420	49869.5				
	whole	214.013	39806.5				
	Total			21666.5	49869.5	-0.3001	0.7641
D06_11	all	211.074	50024.5				
	whole	213.180	39651.5				
	Total			21821.5	50024.5	-0.1759	0.8604
D06_12	all	209.635	49683.5				
	whole	215.013	39992.5				
	Total			21480.5	49683.5	-0.4491	0.6533

D07_08	all	211.371	50095.0				
	whole	212.801	39581.0				
	Total			21892.0	50095.0	-0.1194	0.9049
D07_09	all	212.430	50346.0				
	whole	211.452	39330.0				
	Total			21939.0	39330.0	-0.0817	0.9349
D07_10	all	214.215	50769.0				
	whole	209.177	38907.0				
	Total			21516.0	38907.0	-0.4207	0.6740
D07_11	all	214.677	50878.5				
	whole	208.589	38797.5				
	Total			21406.5	38797.5	-0.5085	0.6111
D07_12	all	215.386	51046.5				
	whole	207.685	38629.5				
	Total			21238.5	38629.5	-0.6431	0.5202
D08_09	all	213.363	50567.0				
	whole	210.263	39109.0				
	Total			21718.0	39109.0	-0.2588	0.7958
D08_10	all	213.574	50617.0				
	whole	209.995	39059.0				
	Total			21668.0	39059.0	-0.2989	0.7650
D08_11	all	212.025	50250.0				
	whole	211.968	39426.0				
	Total			22035.0	39426.0	-0.0048	0.9962
D08_12	all	213.363	50567.0				
	whole	210.263	39109.0				
	Total			21718.0	39109.0	-0.2588	0.7958
D09_10	all	213.831	50678.0				
	whole	209.667	38998.0				
	Total			21607.0	38998.0	-0.3478	0.7280
D09_11	all	214.013	50721.0				
	whole	209.435	38955.0				
	Total			21564.0	38955.0	-0.3823	0.7023
D09_12	all	215.918	51172.5				
	whole	207.008	38503.5				
	Total			21112.5	38503.5	-0.7441	0.4568
D10_11	all	213.981	50713.5				
	whole	209.476	38962.5				
	Total			21571.5	38962.5	-0.3762	0.7067
D10_12	all	214.937	50940.0				
	whole	208.258	38736.0				
	Total			21345.0	38736.0	-0.5577	0.5770
D11_12	all	215.230	51009.5				
	whole	207.884	38666.5				
	Total			21275.5	38666.5	-0.6135	0.5396

APPENDIX H

Factor Analysis Results

Study 1:
Using Only 12 Bipolar Scales, Drawn from E-P-A Factors in Previous Studies

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Com-ponent	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.0724	42.2704	42.2704	5.0724	42.2704	42.2704	4.9466	41.2215	41.2215
2	1.4827	12.3556	54.6260	1.4827	12.3556	54.6260	1.6085	13.4045	54.6260
3	0.8287	6.9058	61.5318						
4	0.6999	5.8325	67.3643						
5	0.6544	5.4537	72.8179						
6	0.6169	5.1405	77.9584						
7	0.5337	4.4474	82.4058						
8	0.5236	4.3634	86.7692						
9	0.4658	3.8817	90.6510						
10	0.4264	3.5537	94.2047						
11	0.3931	3.2757	97.4804						
12	0.3024	2.5196	100.0000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix

	Component	
	1	2
GOOD1	0.8161	-0.0118
HONEST1	0.6301	0.0967
FAIR1	0.7733	0.0389
PLEASAN1	0.7877	-0.1458
VALUABL1	0.7274	0.0863
STRONG2	0.7610	0.1595
LARGE2	0.3976	0.5149
HEAVY2	0.1162	0.7879
HARD2	-0.1337	0.7546
FAST3	0.6240	0.0433
ACTIVE3	0.6697	0.2277
SHARP3	0.7277	0.1850

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 3 iterations.

Component Transformation Matrix

Component	1	2
1	0.9823	0.1872
2	-0.1872	0.9823

Study 2:
Using All 15 Bipolar Scales

Total Variance Explained

Com-ponent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.4756	36.5042	36.5042	5.4756	36.5042	36.5042	5.4245	36.1630	36.1630
2	1.8150	12.1000	48.6042	1.8150	12.1000	48.6042	1.8662	12.4412	48.6042
3	0.9781	6.5207	55.1250						
4	0.8422	5.6144	60.7394						
5	0.7708	5.1387	65.8781						
6	0.6868	4.5789	70.4570						
7	0.6538	4.3584	74.8154						
8	0.6105	4.0697	78.8851						
9	0.5713	3.8087	82.6938						
10	0.5240	3.4936	86.1874						
11	0.5128	3.4189	89.6063						
12	0.4516	3.0104	92.6166						
13	0.4186	2.7908	95.4075						
14	0.3907	2.6044	98.0119						
15	0.2982	1.9881	100.0000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix

	Component	
	1	2
GOOD1	0.8043	-0.0246
HONEST1	0.6332	0.0881
FAIR1	0.7662	0.0328
PLEASAN1	0.7780	-0.1664
VALUABL1	0.7170	0.0964
STRONG2	0.7654	0.1367
LARGE2	0.4224	.0.4772
HEAVY2	0.1561	0.7036
HARD2	-0.1059	0.7359
FAST3	0.6214	0.0282
ACTIVE3	0.6790	0.1769
SHARP3	0.7299	0.1643
CONFIDE4	0.6309	-0.0548
FEMININ5	-0.1248	-0.3098
SIMPLE6	0.2773	-0.6155

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 3 iterations.

Component Transformation Matrix

Component	1	2
1	0.9930	0.1182
2	-0.1182	0.9930

Study 3:
Using All 15 Bipolar Scales, Forcing 3 Factors

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Com-ponent	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.4756	36.5042	36.5042	5.4756	36.5042	36.5042	5.4219	36.1463	36.1463
2	1.8150	12.1000	48.6042	1.8150	12.1000	48.6042	1.7932	11.9546	48.1009
3	0.9781	6.5207	55.1250	0.9781	6.5207	55.1250	1.0536	7.0241	55.1250
4	0.8422	5.6144	60.7394						
5	0.7708	5.1387	65.8781						
6	0.6868	4.5789	70.4570						
7	0.6538	4.3584	74.8154						
8	0.6105	4.0697	78.8851						
9	0.5713	3.8087	82.6938						
10	0.5240	3.4936	86.1874						
11	0.5128	3.4189	89.6063						
12	0.4516	3.0104	92.6166						
13	0.4186	2.7908	95.4075						
14	0.3907	2.6044	98.0119						
15	0.2982	1.9881	100.0000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix

	Component		
	1	2	3
GOOD1	0.7935	-0.0860	0.1252
HONEST1	0.6448	0.0740	-0.0573
FAIR1	0.7605	-0.0215	0.1047
PLEASAN1	0.7583	-0.2299	0.1274
VALUABL1	0.7296	0.0794	-0.0607
STRONG2	0.7731	0.1010	0.0243
LARGE2	0.4499	0.4632	0.0247
HEAVY2	0.1916	0.6935	0.0843
HARD2	-0.0825	0.7060	0.2391
FAST3	0.6271	0.0081	-0.0315
ACTIVE3	0.6833	0.1325	0.0885
SHARP3	0.7327	0.1154	0.0985
CONFIDE4	0.6300	-0.0809	-0.0128
FEMININ5	-0.0617	-0.1180	-0.9368
SIMPLE6	0.2226	-0.6820	0.2049

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 3 iterations.

Component Transformation Matrix

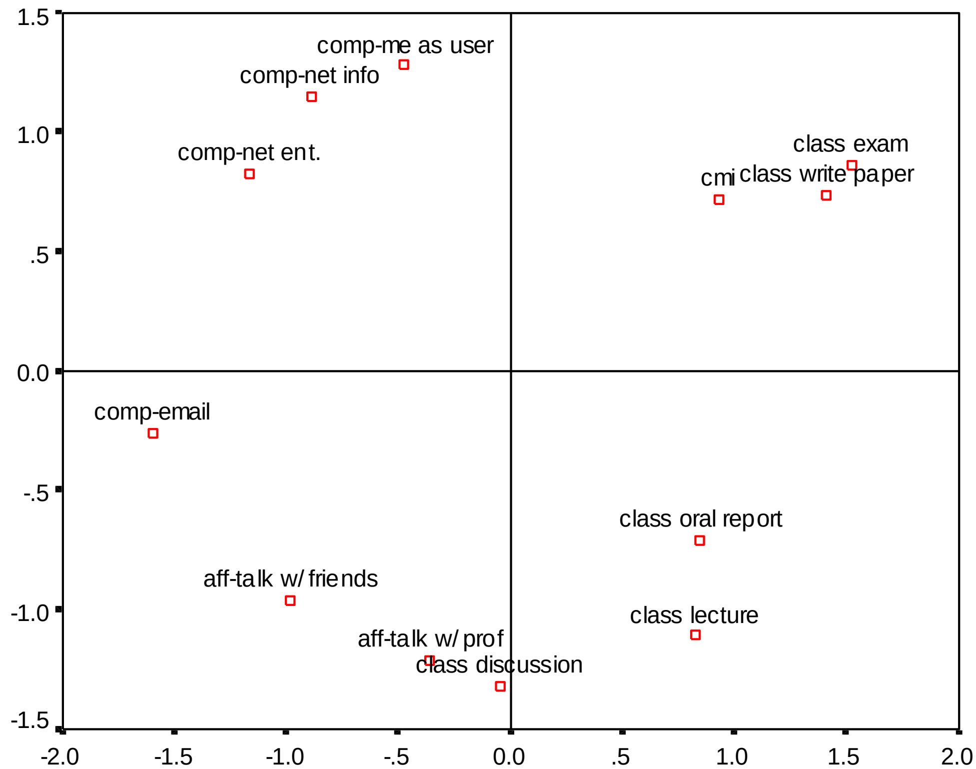
Component	1	2	3
1	0.9935	0.0569	0.0987
2	-0.0754	0.9780	0.1945
3	0.0855	0.2006	-0.9759

APPENDIX I-1

Figure 2
All Participants: MDS Mapping of 12 Concepts x 15 Bipolar Scales

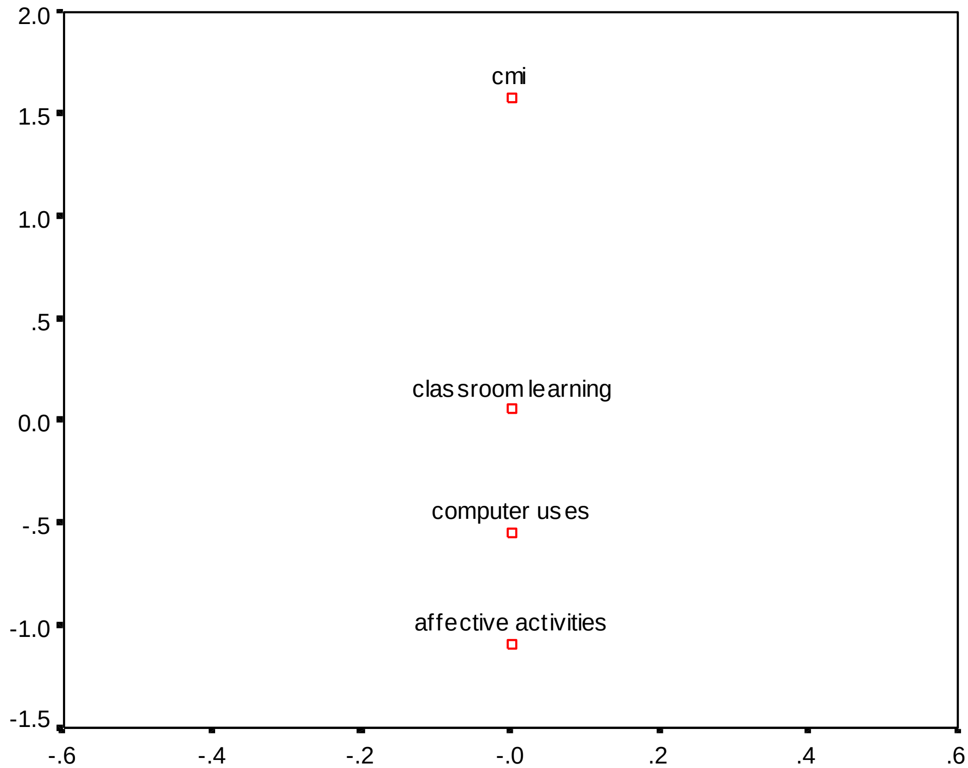
APPENDIX 1-2

Figure 3
All Participants: MDS Mapping of 12 Concepts x 6 Factors



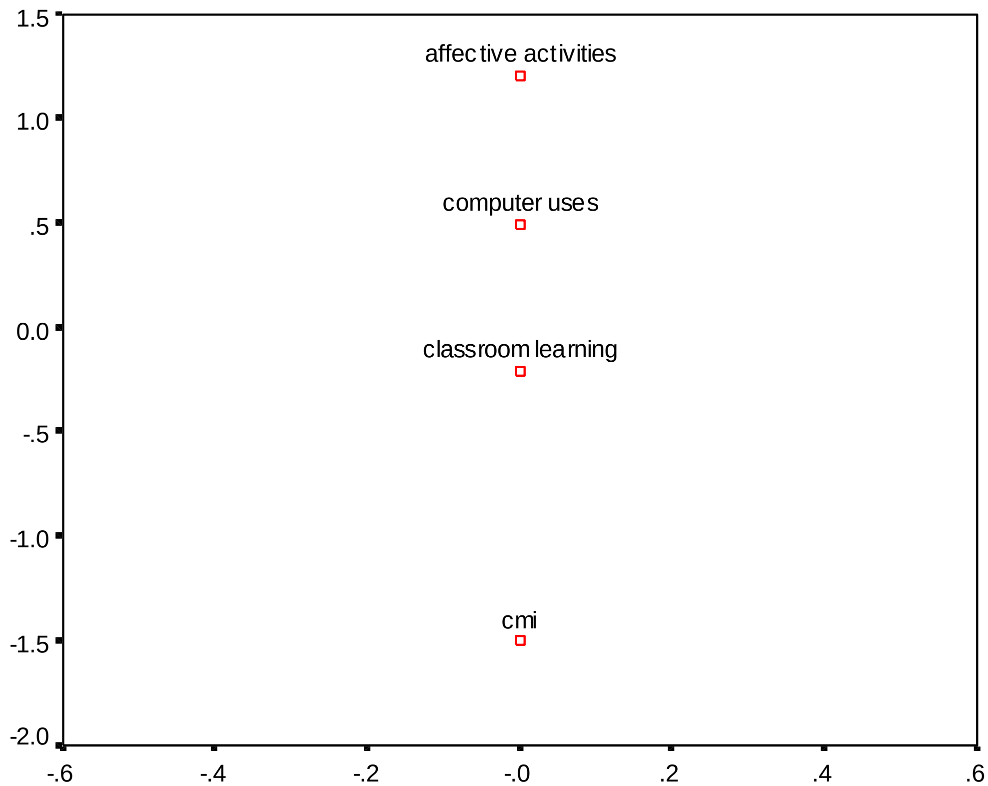
APPENDIX I-3

Figure 4
All Participants: MDS Mapping of 4 Issues x 15 Bipolar Scales



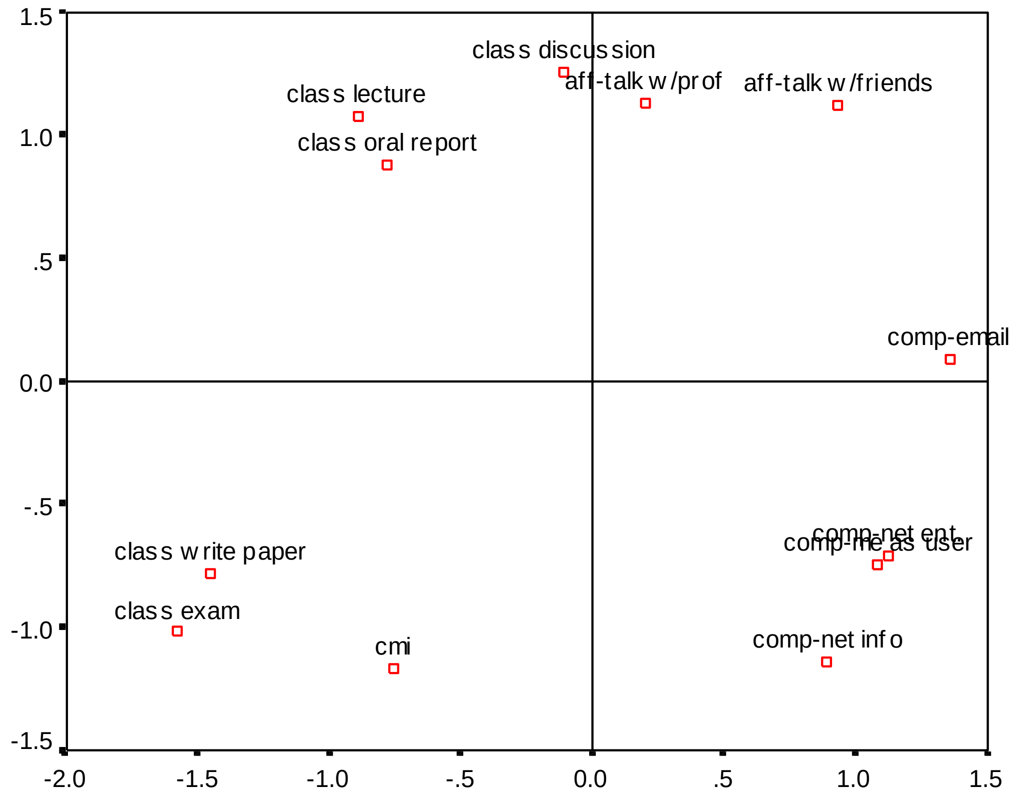
APPENDIX I-4

Figure 5
All Participants: MDS Mapping of 4 Issues x 6 Factors



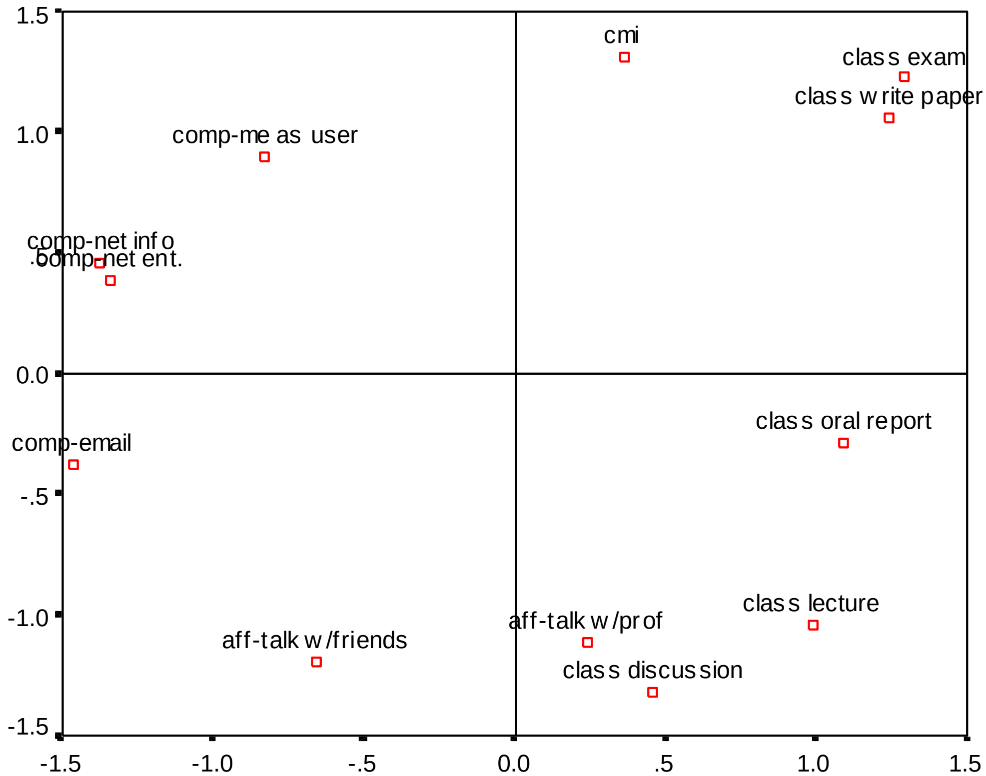
APPENDIX J-1

Figure 6
Female Participants: MDS Mapping of 12 Concepts x 15 Bipolar Scales



APPENDIX J-2

Figure 7
Male Participants: MDS Mapping of 12 Concepts x 15 Bipolar Scales



APPENDIX J-3

One-Way ANOVA Results
Gender Differences on **Anxiety** Scale for 12 Concepts

Concepts:		Sum of Squares	df	Mean Square	F	Sig.
1	Between Groups	.209	1	.209	.089	.766
	Within Groups	506.178	215	2.354		
	Total	506.387	216			
2	Between Groups	7.847E-03	1	7.847E-03	.004	.950
	Within Groups	437.700	217	2.017		
	Total	437.708	218			
3	Between Groups	8.878E-03	1	8.878E-03	.004	.950
	Within Groups	489.390	216	2.266		
	Total	489.399	217			
4	Between Groups	2.114	1	2.114	.750	.388
	Within Groups	609.028	216	2.820		
	Total	611.142	217			
5	Between Groups	1.354	1	1.354	.469	.494
	Within Groups	621.143	215	2.889		
	Total	622.498	216			
6	Between Groups	4.337	1	4.337	1.407	.237
	Within Groups	659.497	214	3.082		
	Total	663.833	215			
7	Between Groups	1.182	1	1.182	.485	.487
	Within Groups	526.598	216	2.438		
	Total	527.780	217			
8	Between Groups	2.877	1	2.877	1.358	.245
	Within Groups	459.708	217	2.118		
	Total	462.584	218			
9	Between Groups	7.551	1	7.551	3.427	.065
	Within Groups	478.102	217	2.203		
	Total	485.653	218			
10	Between Groups	.560	1	.560	.230	.632
	Within Groups	528.079	217	2.434		
	Total	528.639	218			
11	Between Groups	3.804	1	3.804	1.189	.277
	Within Groups	690.857	216	3.198		
	Total	694.661	217			
12	Between Groups	8.163	1	8.163	2.657	.105
	Within Groups	654.469	213	3.073		
	Total	662.633	214			

APPENDIX J-4

One-Way ANOVA Results
Gender Differences on **Gender** Scale for 12 Concepts

Concepts:		Sum of Squares	df	Mean Square	F	Sig.
1	Between Groups	63.761	1	63.761	44.462	.000
	Within Groups	306.887	214	1.434		
	Total	370.648	215			
2	Between Groups	21.473	1	21.473	16.817	.000
	Within Groups	274.527	215	1.277		
	Total	296.000	216			
3	Between Groups	5.567	1	5.567	3.496	.063
	Within Groups	345.538	217	1.592		
	Total	351.105	218			
4	Between Groups	91.261	1	91.261	50.195	.000
	Within Groups	390.896	215	1.818		
	Total	482.157	216			
5	Between Groups	49.625	1	49.625	33.527	.000
	Within Groups	318.228	215	1.480		
	Total	367.853	216			
6	Between Groups	25.548	1	25.548	18.736	.000
	Within Groups	290.434	213	1.364		
	Total	315.981	214			
7	Between Groups	202.668	1	202.668	126.218	.000
	Within Groups	348.437	217	1.606		
	Total	551.105	218			
8	Between Groups	26.566	1	26.566	12.591	.000
	Within Groups	455.728	216	2.110		
	Total	482.294	217			
9	Between Groups	157.763	1	157.763	82.832	.000
	Within Groups	411.397	216	1.905		
	Total	569.161	217			
10	Between Groups	51.824	1	51.824	34.773	.000
	Within Groups	320.425	215	1.490		
	Total	372.249	216			
11	Between Groups	21.637	1	21.637	12.113	.001
	Within Groups	384.041	215	1.786		
	Total	405.677	216			
12	Between Groups	43.698	1	43.698	26.861	.000
	Within Groups	346.516	213	1.627		
	Total	390.214	214			

APPENDIX J-5

One-Way ANOVA Results
Gender Differences on **Complexity** Scale for 12 Concepts

Concepts:		Sum of Squares	df	Mean Square	F	Sig.
1	Between Groups	3.367	1	3.367	1.432	.233
	Within Groups	505.628	215	2.352		
	Total	508.995	216			
2	Between Groups	2.541E-02	1	2.541E-02	.010	.922
	Within Groups	565.680	215	2.631		
	Total	565.705	216			
3	Between Groups	7.847E-03	1	7.847E-03	.002	.963
	Within Groups	803.700	217	3.704		
	Total	803.708	218			
4	Between Groups	.625	1	.625	.266	.606
	Within Groups	507.343	216	2.349		
	Total	507.968	217			
5	Between Groups	7.499	1	7.499	2.985	.085
	Within Groups	542.598	216	2.512		
	Total	550.096	217			
6	Between Groups	.406	1	.406	.180	.672
	Within Groups	482.631	214	2.255		
	Total	483.037	215			
7	Between Groups	6.199	1	6.199	2.202	.139
	Within Groups	608.021	216	2.815		
	Total	614.220	217			
8	Between Groups	11.274	1	11.274	4.879	.028
	Within Groups	499.152	216	2.311		
	Total	510.427	217			
9	Between Groups	1.312	1	1.312	.452	.502
	Within Groups	629.985	217	2.903		
	Total	631.297	218			
10	Between Groups	9.654	1	9.654	3.667	.057
	Within Groups	571.359	217	2.633		
	Total	581.014	218			
11	Between Groups	5.287	1	5.287	1.691	.195
	Within Groups	672.390	215	3.127		
	Total	677.677	216			
12	Between Groups	2.747	1	2.747	.699	.404
	Within Groups	849.180	216	3.931		
	Total	851.927	217			

APPENDIX K-1

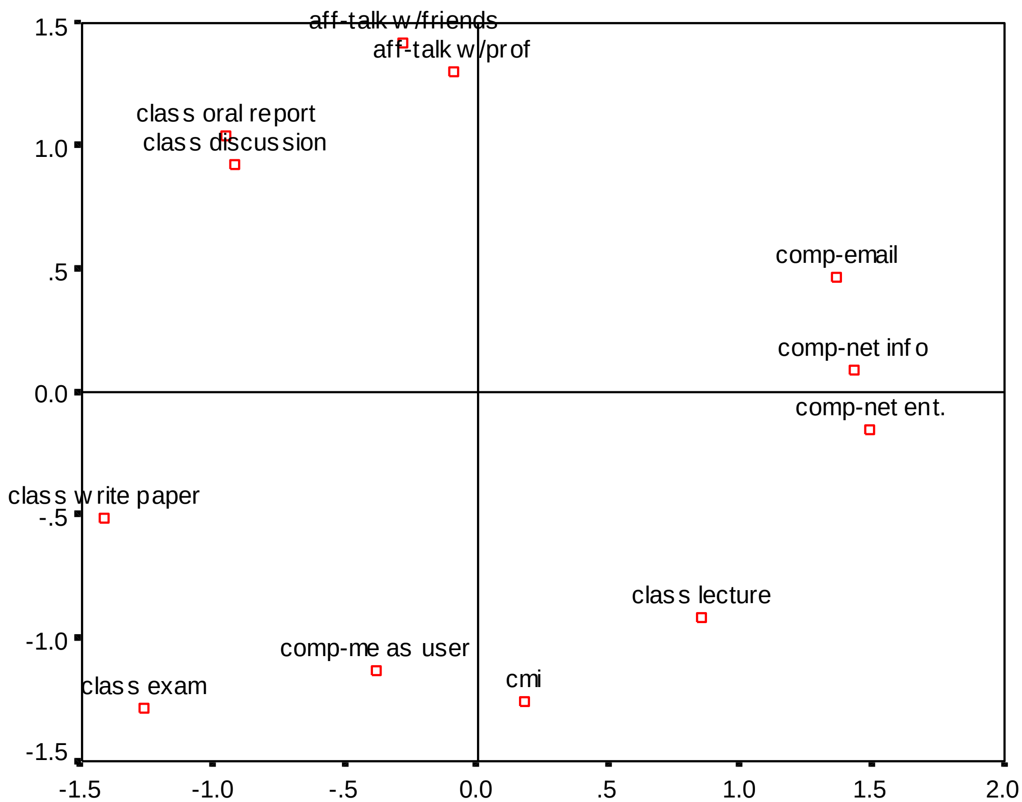
Pearson Correlation Results
Anxiety Scales of Four Issues

		CMI	Traditional classroom	Affective activities
Traditional classroom	r =	**0.415**		
	p =	0.000		
Affective activities	r =	0.066	**0.264**	
	p =	0.371	0.000	
Computer uses	r =	**0.435**	**0.364**	**0.266**
	p =	0.000	0.000	0.000

Bold type indicates correlation with two-tailed significance at .05 level

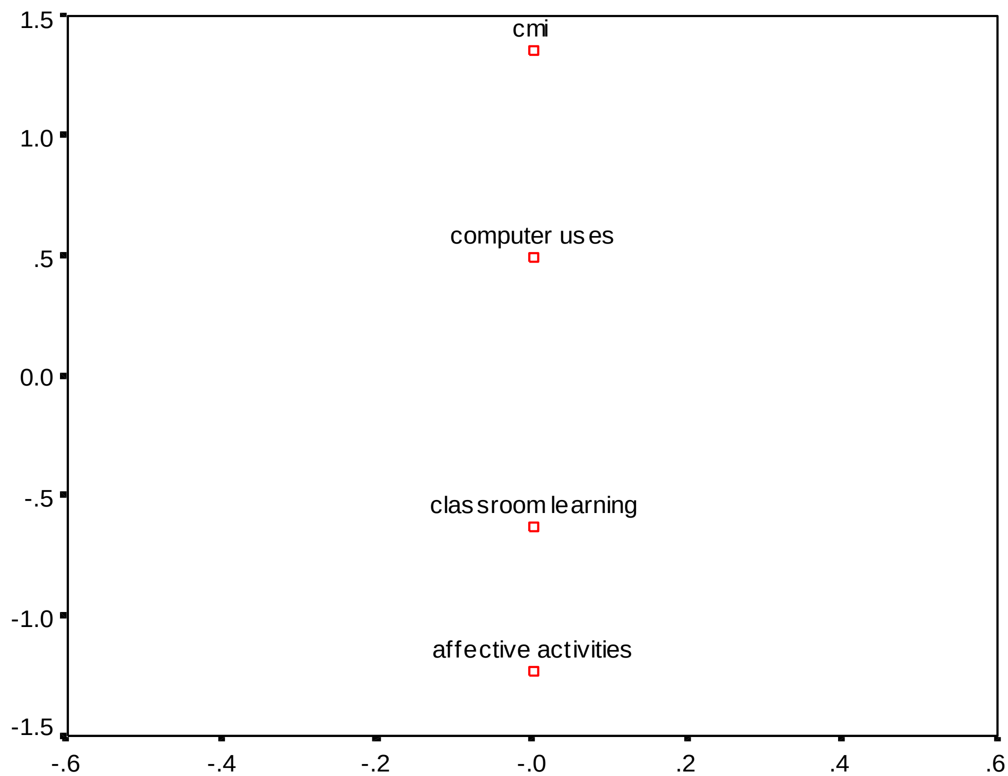
APPENDIX K-2

Figure 8
All Participants: MDS Mapping of 12 Concepts x 1 Bipolar Scale (Anxiety)



APPENDIX K-3

Figure 9
All Participants: MDS Mapping of 4 Issues x 1 Bipolar Scale (Anxiety)

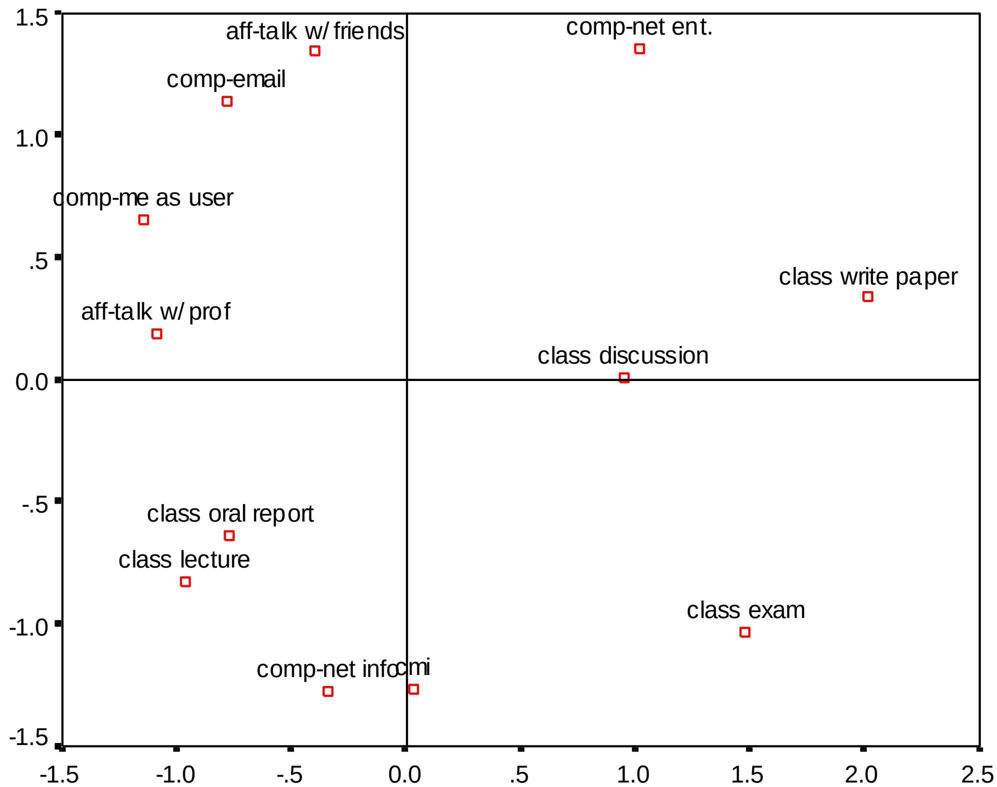


APPENDIX L-1

Figure 10
Students: MDS Mapping of 12 Concepts x 15 Bipolar Scales

APPENDIX L-2

Figure 11
Faculty: MDS Mapping of 12 Concepts x 15 Bipolar Scales



APPENDIX L-3

Students vs. Faculty: One-Way ANOVA on 12 Concepts x 1 Bipolar Scale ("Anxiety")

		Sum of Squares	df	Mean Square	F	Sig.
C01S13	Between Groups	7.036875	1	7.036875	3.035795	0.082766
	Within Groups	540.0865	233	2.317968		
	Total	547.1234	234			
C02S13	Between Groups	1.778444	1	1.778444	0.892632	0.345736
	Within Groups	468.2047	235	1.99236		
	Total	469.9831	236			
C03S13	Between Groups	4.950814	1	4.950814	2.100995	0.148542
	Within Groups	551.4009	234	2.356414		
	Total	556.3517	235			
C04S13	Between Groups	10.83857	1	10.83857	3.964163	0.047642
	Within Groups	639.7885	234	2.734139		
	Total	650.6271	235			
C05S13	Between Groups	1.423931	1	1.423931	0.483923	0.487344
	Within Groups	685.5973	233	2.942478		
	Total	687.0213	234			
C06S13	Between Groups	0.91094	1	0.91094	0.292449	0.589174
	Within Groups	722.6489	232	3.114866		
	Total	723.5598	233			
C07S13	Between Groups	2.226072	1	2.226072	0.855775	0.355877
	Within Groups	608.6892	234	2.601236		
	Total	610.9153	235			
C08S13	Between Groups	3.932952	1	3.932952	1.737219	0.188775
	Within Groups	532.0249	235	2.263936		
	Total	535.9578	236			
C09S13	Between Groups	6.684451	1	6.684451	3.046822	0.082202
	Within Groups	515.5687	235	2.193909		
	Total	522.2532	236			
C10S13	Between Groups	5.042638	1	5.042638	2.024946	0.156061
	Within Groups	585.2105	235	2.490258		
	Total	590.2532	236			
C11S13	Between Groups	4.030372	1	4.030372	1.210079	0.272447
	Within Groups	779.3764	234	3.330668		
	Total	783.4068	235			
C12S13	Between Groups	1.47367	1	1.47367	0.467831	0.494672
	Within Groups	727.6508	231	3.150003		
	Total	729.1245	232			

APPENDIX L-4

Students vs. Faculty: One-Way ANOVA on 12 Concepts x 1 Bipolar Scale ("Gender")

		Sum of Squares	df	Mean Square	F	Sig.
C01S14	Between Groups	0.273504	1	0.273504	0.156459	0.692801
	Within Groups	405.5556	232	1.748084		
	Total	405.8291	233			
C02S14	Between Groups	0.814611	1	0.814611	0.568548	0.451598
	Within Groups	333.8407	233	1.432793		
	Total	334.6553	234			
C03S14	Between Groups	0.5996	1	0.5996	0.366107	0.545718
	Within Groups	384.8772	235	1.637775		
	Total	385.4768	236			
C04S14	Between Groups	3.118979	1	3.118979	1.408364	0.236537
	Within Groups	516.0044	233	2.214611		
	Total	519.1234	234			
C05S14	Between Groups	0.395876	1	0.395876	0.228443	0.633129
	Within Groups	403.7743	233	1.732937		
	Total	404.1702	234			
C06S14	Between Groups	0.462302	1	0.462302	0.312679	0.576583
	Within Groups	341.5377	231	1.478518		
	Total	342	232			
C07S14	Between Groups	0.048135	1	0.048135	0.019246	0.889782
	Within Groups	587.7325	235	2.500989		
	Total	587.7806	236			
C08S14	Between Groups	0.064978	1	0.064978	0.029571	0.863616
	Within Groups	514.185	234	2.197372		
	Total	514.25	235			
C09S14	Between Groups	0.846879	1	0.846879	0.307338	0.579847
	Within Groups	644.793	234	2.755525		
	Total	645.6398	235			
C10S14	Between Groups	0.145811	1	0.145811	0.083548	0.772802
	Within Groups	406.6372	233	1.745224		
	Total	406.783	234			
C11S14	Between Groups	0.000471	1	0.000471	0.000258	0.987193
	Within Groups	424.7655	233	1.823028		
	Total	424.766	234			
C12S14	Between Groups	0.000307	1	0.000307	0.000169	0.989654
	Within Groups	420.2143	231	1.819109		
	Total	420.2146	232			

APPENDIX L-5

Students vs. Faculty: One-Way ANOVA on 12 Concepts x 1 Bipolar Scale ("Complexity")

		Sum of Squares	df	Mean Square	F	Sig.
C01S15	Between Groups	2.997571	1	2.997571	1.254529	0.263842
	Within Groups	556.7301	233	2.3894		
	Total	559.7277	234			
C02S15	Between Groups	11.4359	1	11.4359	4.281563	0.039631
	Within Groups	622.3343	233	2.670963		
	Total	633.7702	234			
C03S15	Between Groups	1.184562	1	1.184562	0.32446	0.569484
	Within Groups	857.9547	235	3.650871		
	Total	859.1392	236			
C04S15	Between Groups	4.439236	1	4.439236	1.893195	0.170157
	Within Groups	548.6921	234	2.344838		
	Total	553.1314	235			
C05S15	Between Groups	0.666785	1	0.666785	0.251044	0.616812
	Within Groups	621.5154	234	2.656049		
	Total	622.1822	235			
C06S15	Between Groups	2.03094	1	2.03094	0.91634	0.339434
	Within Groups	514.1956	232	2.21636		
	Total	516.2265	233			
C07S15	Between Groups	7.06778	1	7.06778	2.529888	0.113058
	Within Groups	653.7288	234	2.793713		
	Total	660.7966	235			
C08S15	Between Groups	5.230228	1	5.230228	2.148589	0.144043
	Within Groups	569.6172	234	2.434262		
	Total	574.8475	235			
C09S15	Between Groups	12.02228	1	12.02228	4.243475	0.040503
	Within Groups	665.7836	235	2.833122		
	Total	677.8059	236			
C10S15	Between Groups	0.553871	1	0.553871	0.200346	0.654854
	Within Groups	649.674	235	2.76457		
	Total	650.2278	236			
C11S15	Between Groups	5.702632	1	5.702632	1.823302	0.178231
	Within Groups	728.7399	233	3.127639		
	Total	734.4426	234			
C12S15	Between Groups	17.73268	1	17.73268	4.504478	0.034857
	Within Groups	921.1826	234	3.936678		
	Total	938.9153	235			

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ABSTRACT

MEANING-RELATED INDICATORS OF AFFECT IN COMPUTER-MEDIATED INSTRUCTION CURRICULUMS

by

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Major: Curriculum and Instruction

Degree: Doctor of Education

The increasing use of computer-mediated instruction in recent years has spawned a revolution in learning and has caused educational practitioners to measure this new mode of learning against the theoretical underpinnings of traditional classroom education. This study specifically looked to find evidence of behaviorally based affective components inside computer-mediated instructional (CMI) experiences, as a first step to determining if the affective domain can exist anywhere there is not a live human teacher present. In education, the affective domain comprises those elements in which students are encouraged to form valuative, emotional, attitudinal, aesthetic, and/or integrational judgments about the cognitive learning processes undertaken. Previous CMI studies involving the affective component centered mainly on gender-related issues and on computer anxiety and self-efficacy, and so individual gender and anxiety scales were added to reflect these issues. The study used the Semantic Differential inventory tool to examine students' perceptions through their meaning-derived reactions to a series of twelve behaviorally based activities, chosen to represent (1) computer-mediated learning, (2) traditional classroom activities, (3) affectively laden activities, and (4) non-classroom uses of computers. Multidimensional scaling (MDS) produced two-dimensional mappings of students' meaning-derived perceptions of these activities. The study found evidence that CMI is least associated with the affective activities, that it is also dissociated with oral portions of traditional classroom learning (e.g., giving an oral report, class discussion, and classroom lectures), and that it is most closely associated with written aspects of the traditional classroom (e.g., taking an exam or writing a paper). Non-classroom uses of computers (e.g., use of e-mail, use of Internet) seem to be dissociated with all of the above. Both MDS mappings and ANOVA demonstrated no gender-related differences in any of these perceptions except on the individual Gender scale. On the Anxiety scale, participants showed low levels of correlation between CMI and affective activities, but high correlation between CMI and both traditional classroom activities and non-classroom uses of computers. In sum, not only were gender differences on computer usage debunked, but the study’s findings of the wide gap in students’ mappings of affect and CMI provides new evidence that curricularists wishing to integrate affective domain into CMI have challenges in bringing the two concepts together--if in fact that is possible in a learning environment where there is no live human teacher.

AUTOBIOGRAPHICAL STATEMENT

GROVER B. PROCTOR, JR.

Born in Raleigh, North Carolina, I attended the University of North Carolina, where I obtained a B.A. with Honors in Speech Communications in 1973. My Master's degree, also in Communications, was from Central Michigan University. My Master's thesis involved trying to find a way to conceptually dissociate public speaking performance anxiety ("stage fright") from shyness. My doctoral work at Wayne State University specialized in various curricular aspects of computer-mediated instruction.

Like Caesar's Gaul, my professional career has been divided into three parts. The first began in the mid-1970s in broadcasting in central North Carolina. I did network radio news, classical music broadcasting, and was Founder and Producer of *WPTF's Third Dimension*, the first classical music service produced by radio exclusively for the use of the cable television industry. The second section of my career was in symphony orchestra management, which I did with the North Carolina Symphony, the Hartford (CT) Chamber Orchestra, and the Midland (MI) Symphony Orchestra. In this period, there was a brief interregnum in which I worked as an Arts Editor and Writer for a friend's start-up cultural publication ("Spectator Magazine") in Raleigh, NC. In all of the years since, I have written classical concert and recording reviews for various local, regional, and national publications.

Finally, in 1985, I returned to my first professional love, academia, when I joined Northwood University, first as a consultant and adjunct professor, and later as a full time academic administrator and Dean. I have taught mathematics (statistics and quantitative analysis), public speaking, computer science, philosophy, music appreciation, and business writing at Northwood. My administrative career began as Director of Counseling Services, then moved to Associate Dean of the school's adult degree completion program, then to Assistant to the Dean of the Graduate School, and most recently to Associate Dean of Academic Administration for the university's three-campus system. I have just this year taken on a second and concurrent appointment as Executive Director of Northwood's Alden B. Dow Creativity Center and its National Arts Programs.

I live in Midland, Michigan, with my wife Adrianne. We share a great love and obsession for our two beautiful nieces, Bridget and Celsiana, and I am Godfather for my colleague and dear friend's daughters Sarah and Emma.