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APPLIED INFORMATION MANAGEMENT

The Relationships between Selected Sources of Computer Anxiety Experienced by Beginning Computer Users and Approaches to Computer-based Training

CAPSTONE REPORT

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Abstract
for
The Relationships between Selected Sources of Computer Anxiety
Experienced by Beginning Computer Users and Approaches to Computer-
based Training

As dependence upon computers becomes more prevalent in the workplace,

providing effective computer-based training to workers is vital to employee

success. However, many workers suffer from various forms of computer anxiety.

This study examines the relationship between five sources of computer anxiety

including age, gender, instructional method, general psychological factors and

previous exposure to computers and the successful design of computer-based

instruction. Four cases are compared to Kolb's Learning Cycle (Harb & Terry,

1992).

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CHAPTER I – PURPOSE OF STUDY

Brief Purpose

The purpose of the study is to examine potential relationships between computer anxiety and ways of designing computer-based training in the workplace. The examination is framed in two parts. Part One is designed to identify and describe the variety of characteristics of computer anxiety experienced by the beginning computer user, as these are reported in selected literature. For the purposes of this paper, computer anxiety is defined as the "fear of impending interaction with a computer that is disproportionate to the actual threat presented by the computer" (Howard, Murphy & Thomas (1986) as cited by Orr (n.d.))

Desai (2001) demonstrates that computer anxiety is linked to the effectiveness of computer training in a negative manner. Igbaria & Chakrabarli (1990) extend this notion and state that computer anxiety and stress may cause computer anxious users to avoid using computers completely. Part Two is designed to examine four pre-selected case examples of computer training that are reported to be successfully designed to address and mitigate specific characteristics of computer anxiety.

The larger method of study is literature review (Leedy and Ormrod, 2001). Literature review is chosen as an appropriate method for this study because it "… describes theoretical perspectives and previous research findings related to the

problem at hand"; in this case, computer anxiety and computer–based training methods designed to mitigate the effects of computer anxiety.

Literature is collected from materials published between 1983 and 2005, and focused on the topics of (1) computer anxiety and (2) case examples of computer training. Searches for appropriate literature are conducted in databases (CiteSeer, Academic Search Premier, PsycInfo, Web of Science), by web searches (Google, AltaVista, Yahoo, Dogpile) and periodicals (ArticleFirst, Computer Source, Psychology & Behavioral Sciences Collection, Newsweek). Search terms include: (1) anxiety, (2) computer anxiety, (3) computer stress, (4) anxious computer users, (5) psychology and computers, (6) barriers to computer learning, (7) computer pedagogy, (8) computer training.

Selected literature is reviewed using content analysis as described by (Palmquist et al., 2005). The analysis is conducted in two stages. Part One, addressing the literature in the area of computer anxiety, is designed to identify characteristics of computer anxiety, defined by the following selected sources: (a) age, which distinguishes between seniors (62+) and the rest of the population (Baldi, 1997), (b) gender (Solvberg, 2002), (c) instructional method (Goldsborough, 2002), (d) general psychological factors (Galagan, 1983) and (e) previous exposure to computers (Loyd and Gressard, 1984). Part Two, addressing the literature in the area computer training is designed to examine four pre-selected case examples

of computer-based training that are reported to have successfully addressed those specific categories of anxiety.

Part One of the content analysis results in a list of terms defining the various characteristics of computer anxiety, as identified in the literature (see Table 2: Characteristics of Computer Anxiety). Part Two results in a set of summary profiles of each of the four pre-selected case examples of training on computers.

The outcomes of this study are presented in two forms, designed for educators in the field of computer-based training. These are: (1) a table (see Table 2) listing the reported characteristics of computer anxiety experienced by the beginning computer user, including original research citations. Characteristics are aligned in Table 2 with a set of pre-defined sources of computer anxiety, (age, gender, instructional method, general psychological factors and previous exposure to computers) and (2) a set of four summary profiles, presenting each of the four pre-selected cases with evaluative paragraphs discussing the specifics of the case and it's relevance to the study. By understanding the characteristics of computer anxiety and by showing the ways that computer-based training has been successfully designed to address and mitigate some of these characteristics of computer anxiety, the researcher hopes that educators in the field of computer training will be better able to design and present training in the most effective manner.

Full Purpose

Orr (n.d.) states that dependence on computers is becoming more and more prevalent in the workplace and in education as well. In the workplace, computer avoidance lowers performance in the business environment and ultimately reduces the chance for career advancement and "Avoidance can seriously affect some students academic progress" (Brown & Vican, 1997 as cited by Orr n.d.). The computer is the second most common piece of equipment in the workplace, (Kromer & Price, 1982 as cited by Baldi, 1997). This new technology requires workers to gain new skills and competencies in order to be effective (Baldi, 1997). Thus, providing effective computer-based training to workers is vital to their employers' success (Baldi, 1997).

Part One of the study is designed to identify and describe the characteristics of computer anxiety experienced by the beginning computer user. There are many definitions of computer anxiety, including (1) "…fear of impending interaction with a computer that is disproportionate to the actual threat presented by the computer" (Howard, Murphy & Thomas, 1986); (2) "… the complex emotional reactions that are evoked in individuals who interpret computers as personally threatening" (Morgan, n.d. Section 2, Paragraph 3). (3) … "those who fear using computers or become afraid at the prospect of using them" (Smith, 1990). For the purposes of this study, the term computer anxiety refers to the Howard, Murphy & Thomas definition, with emphasis on disproportionate fear of

interaction. A complete set of definitions used in this paper is presented in Appendix C.

As reported by researchers, the sources of this type of computer anxiety include such things as age (Baldi, 1997), gender (Solvberg, 2002), instructional method (Goldsborough, 2002), general psychological factors (Galagan, 1983) and previous exposure to computers (Loyd and Gressard, 1984). Beginning computer users report their anxiety in different ways. Morgan (n.d.), reports that "To the computer anxious person the use of a computer or even the thought of the future use of a computer can cause them to experience feelings associated with anxiety such as fear, embarrassment, disappointment, irritation, and frustration." (Morgan, n.d. Section 2, paragraph 2.) Other categories identified in the literature, related to cultural differences (Kaczmarczyk, n.d.; Graff, Davies and McNorton, n.d.), race (Schweikart, 2002) are not considered.

Part Two of the study is designed to examine four pre-selected case examples of ways that computer training has been successfully designed to address and mitigate these characteristics of computer anxiety. For the purposes of this study, successful training is measured by reported levels of anxiety by the participants in case examples and by explicit test scores indicating a reduction in anxiety and/or an improvement in retained learned information. (Atkinson, 2004; Latimore, 1996; Orr, n.d.) Pre-selected case examples include (1) training the elderly to become self sufficient on the Internet to learn more about their health

issues (Campbell and Wabby, 2003), (2) training older adults to use computers in the workplace (Baldi, 1997), (3) training teachers to replace the anxiety of a student with confidence (Latimore, 1996), (4) designing instructional guidelines for teachers to use when developing computer-training methodologies (Rakes, 1989) and (5) end-user training: a meta model (Desai & Richards 1999). Included in the review of the pre-selected cases is an analysis of pedagogical methods, based on a set of definitions provided by Harb and Terry (1992). Harb and Terry use the Kolb Learning Cycle (see Appendix A) to categorize different pedagogical teaching techniques into four areas. The fours areas are: **Why**, referring to teaching techniques that address the introduction of the subject; **What**, referring to teaching techniques that provides information to the students that allow them to organize and integrate new material; **How,** referring to teaching techniques that address the mechanics of applying the material; and **What if,** referring to teaching techniques that provide opportunity for self-discovery and for the student to evaluate performance. A determination of teaching techniques in each of the pre-selected cases follows the guidelines set by Harb and Terry (1992) (see Appendix B).

The outcome of the study is designed for educators in the computer-based training arena. Educators in the field include (1) corporate training departments tasked with training employees within their organization (Smith, 1990) and (2) teachers in secondary and post-secondary schools (Desai, 2001). Administrators and managers responsible for training teams have found that the

employees are "… anxious about the advent and use of computers" (Smith, 1990). Smith postulates that this fear leads to aversion to the learning programs, which subsequently leads to poor performance. In a post-secondary education environment, Desai demonstrates that "computer anxiety discouraged computer use" and that further leads to poor test scores on the subject taught. Thus, both the organizational educator and the classical educator benefit from the study's analysis of computer anxiety.

The outcomes of this study are presented in two forms. These include: (1) a table, listing of the reported characteristics of computer anxiety experienced by the beginning computer user, including original research citations and aligned with a set of pre-determined sources of computer anxiety; and (2) a set of summary profiles, of each of the pre-selected four case examples of computer based training designed to successful mitigate computer anxiety.

By analyzing the outcomes of the study, the researcher hopes to provide educators in the field of computer education an understanding of the sources of computer anxiety, and more importantly to provide these educators with case examples of what methods and techniques others have used to mitigate the effects of computer anxiety on the student. Being able to apply what others have done to lessen computer anxiety in students is the ultimate goal.

Significance

This study is needed for the following reasons: (1) Dependence on computers is becoming more and more important prevalent in the workplace and in education as well (Orr, n.d.). In the workplace, avoidance lowers performance in the business environment and ultimately reduces the chance for career advancement (Brown & Vican, 1997 as cited by Orr n.d.). In education, "Avoidance can seriously affect some students academic progress…" (2) Educators sometimes suffer from computer anxiety, thus hindering the adoption of computer training available to them (Edmondson, n.d.). (3) Older adults are the fastest growing segment of the population (Baldi, 1997). That, coupled with older adults working longer, has forced many older new computer users into the workforce. Thus, training these older adults is vital to their employers' success (Baldi, 1997). (4) Technology has made the computer the second most common piece of equipment in the workplace (Kromer & Price, 1982 as cited by Baldi, 1997), and this new technology requires workers to gain new skills and competencies in order to be effective (Baldi, 1997).

Desai (2001) demonstrates that computer anxiety is linked to the effectiveness of computer training in a negative manner. With the ever-expanding prevalence of computers in business and into the fabric of everyday life, the effectiveness of computer training becomes increasingly important. Orr (n.d.) extends the idea that there is a gap between the computer-comfortable and the computer-phobic by stating, "As the academic and business environments continue to move

forwarding computer technology, the gap is widening for those people who experience computer anxiety". Igbaria & Chakrabarli (1990) support this notion and state that computer anxiety and stress may cause the beginning computer user to avoid using computers completely. This is phenomenon is especially apparent when it come to the elderly, "… fewer than 31 percent of seniors older than 65 have ventured online" (Joseph and Stone 2005). While at one time seniors in didn't play much of a role in the workplace, their presence in the workplace is rapidly changing, as reported by Mosner, Spiezle and Emerman (2003):

> "Although people are retiring in greater numbers, there are many workers who need to remain employed. AARP reports that 69 percent of employees over the age of 45 plan to continue working past 65. Americans are now staying in their jobs longer or, when downsized, finding new jobs, changing careers or becoming self-employed. The economic recession that began in 2001 is causing many retirees and "pre-retirees" to re-evaluate their plans and their lifestyles. Many are foregoing trips and major purchases, while others are shifting leisure activities to accommodate full- or part-time employment. Based on a July 2002 poll by the Gallup Organization, 46 percent of working adults expect to retire later due to the recent stock market decline." (p. 7).

Limitations

• Categories (sources) of computer anxiety:

The study is limited to an examination of non-phobic manifestations of computer anxiety, including avoidance, apprehension and uneasiness. These manifestations were chosen because of their reported prevalence by beginning computer users, and include age (Baldi, 1997), gender (Solvberg, 2002), instructional method (Goldsborough, 2002), general psychological factors (Galagan, 1983) and previous exposure to computers (Loyd and Gressard, 1984). In the case of "age" as a source, two classifications are used, those between 18 and 62 years old, and those over 62 years old. The study is not a medical or psychological study of computerphobia and does not examine cultural issues. Therefore, cases where logizomechanophobia is indicated are ignored. Cultural differences, race, and social-economic status are ignored. Studies involving students with mental disabilities or other learning disorders are ignored.

• Timeframe for literature selection:

The timeliness of the literature reviewed is not a factor in deciding whether or not to include the data in the study. Much of the literature referenced is up to 22 years old (Rakes, 1989; Loyd and Gressard 1984, Galagan 1983). This is not viewed as a defect in the study; rather it speaks to the relevance of the data and not the dates.

• Identification of pedagogical methods.

An analysis of specific pedagogical methods presented in each pre-selected case is not done since (1), the breadth of the subject is vast and (2) the lexicon on the subject of pedagogical is as equally vast. However, the pedagogical method(s) used in each case example is identified according to a strategy developed by Kolb, as presented by Harb and Terry (1992) to adequately address the characteristics of the selected method.

• Other influences related to computer anxiety:

Cognitive styles, while likely to play a significant role in determining effective training (Atkinson, 2004), are not included in the study because of the breadth of the topic.

• Pre-selection of cases demonstrating successful computer training:

Successful training is defined in this study as the reported levels of anxiety by the participants in case examples (Goldsborough, n.d.; Smith and Kotrlik, 1990) and by explicit test scores indicating a reduction in anxiety and/or an improvement in retained learned information. The case examples examined in this study are chosen specifically as "good examples", because of their reported success in minimizing the computer anxiety related to the determining factors of computer anxiety. The first case examples, *The Elderly and the Internet: A Case Study* (Campbell & Wabby 2003) provides data that are applicable to age and computer anxiety. *Replacing the Novice Computer User's Anxiety with Confidence* (Latimore, 1996) and *Training 101* (Rakes, 1989) provide general guidelines in

creating training programs. Lastly, *End-User Training: A Meta Model* (Desai and Richards, 1999) explores methods applicable to colleges and business organizations.

• Method of Study:

The larger method of study is literature review (Leedy and Ormrod, 2001). Literature review is chosen as an appropriate method for this study because it "… describes theoretical perspectives and previous research findings related to the problem at hand"; in this case, computer anxiety and training methods designed to mitigate the effects of computer anxiety.

• Focus:

Literature is focused on (1) identification and descriptions of characteristics of computer anxiety and (2) case examples of ways that computer training has been successfully designed to address and mitigate some of these characteristics of computer anxiety.

• Literature Selection Criteria:

Selection criteria for inclusion in the study includes database, index and periodical searches using search terms including: (1) anxiety, (2) computer anxiety, (3) computer stress, (4) anxious computer users, (5) psychology and computers, (6) barriers to computer learning, (7) computer pedagogy, (8) computer training. *Anxiety* and *computer anxiety* were chosen because they are

at the heart of the research topic as numerous sources were located using these terms. *Anxious computer users* proved to be a successful term as well, mainly because the term *anxious computer user* was found to be synonymous with *computer anxiety* (Smith and Kotrlik, n.d.; Orr, n.d.). *Psychology and computers* was used because of the apparent link to psychological factors and computer anxiety (Desai and Richards, 1999). Although the study excludes psychological and medical manifestations of computerphobia, the results of searches using *Psychology and computers* yielded data relevant to the study. *Barriers to computer learning, computer training* and *pedagogy* are search terms used to support the second part of the study, examination of case examples on how computer training has been successfully designed to address and mitigate some of these characteristics of computer anxiety.

• Data Analysis Strategy:

Once the literature is collected, items are reviewed for use in this study. Only those studies that meet the following criteria are actually obtained: full text articles, dissertations and journals obtained online from the University of Oregon Library system and online publications accessed in Spring 2005. The criteria were chosen based on (1) the breadth of material available through these means and (2) the limitations of accessing a library in person.

Selected literature is reviewed using content analysis as described by (Palmquist et al., 2005). The analysis is conducted in two stages. Stage One, addressing the literature in the area of the sources of computer anxiety, is designed to identify characteristics of computer anxiety, defined by the following selected sources: (a) age (Baldi, 1997), (b) gender (Solvberg, 2002), (c) instructional method (Goldsborough, 2002), (d) general psychological factors (Galagan, 1983) and (e) previous exposure to computers (Loyd and Gressard, 1984). These five sources were chosen because of the frequency at which the category occurred when doing general data searches. The frequency of the occurrences of the search terms supports the relevance of the study. Stage Two, addressing the literature in the area computer training is designed to identify case examples of computer-based training methods that address those specific categories of anxiety. Each of four pre-selected cases demonstrates the ways that computer-based training can be tailored to minimize the effects of computer anxiety on the student.

• Pedagogical Methods:

Pedagogical methods are defined in the Kolb Learning Cycle (see Appendix A).

The Kolb Learning Cycle defines pedagogical methods into four areas, "why",

"what", "how" and "what if".

1. **Why**, referring to teaching techniques that:

   a. Introduce the subject

   b. Provide the big picture

   c. Provide meaning

   d. Generate enthusiasm

   e. Show respect and interest;

2. **What**, referring to teaching techniques that:

   a. Provide information to the students

   b. Organize and integrate new material

   c. Provide time for thinking and reflection

3. **How,** referring to teaching techniques that:

   a. Provide opportunity for students to apply the material

   b. Help students to develop problem-solving patterns

   c. Establish a safe leaning environment

4. **What if,** referring to teaching techniques that:

   a. Provide opportunity for self-discovery

   b. Provide opportunities for students to share discoveries

   c. Evaluate performance

The categorizations relative to the Kolb Learning Cycle, presented by Harb and

Terry (1992) (see Appendix B), provide a succinct method of classifying

pedagogical methods discovered in part two of the data analysis portion of this

study. One of the problems in researching pedagogical methods is that there is

no standard lexicon of terms and concepts. The Harb and Terry (1992) approach

is used in this study because it provides a methodology that is based on

experiential learning – one that is readily adaptable to the kinds of techniques

described in the selected references.

Problem Statement

Computer skills have become necessary in education and in the workplace. Being able to successful use a computer has never been more necessary than it is today. In the area of education, libraries now use computer programs to catalog periodicals, articles, dissertations and many other forms of media. Regardless as to level of income, school budget or student demographics; "soon all students will have access to information through the internet" (Orr, n.d.).

In regards to computer usage, the linkage between education and the workplace is readily apparent. "Computer literacy and learning in the higher education curriculum has become imperative in view of the pervasiveness of computer applications at the workplace." (Desai, 2001). In addition, the computer is becoming ubiquitous in the workplace. A 2001 survey by the Department of Commerce and the National Telecommunications Information Agency indicated that more than 57% of the US workforce used personal computers with 80% of the managerial positions, 70% of the technical, sales and administrative support and 20% of the manufacturing positions using computers (Mosner, Spiezle Emerman, 2003). End user applications, such as word processing, spreadsheets, presentation software, desktop publishing and E-Mail have become the skill set required by employers. (Orr, n.d.).

Along with the computer (and technology in general) becoming an important part of everyday living, computer anxiety has also increased. As reported by many researches (Desai, 2001; Smith, 1990; Orr, n.d.; Goldsborough, n.d.), computer anxiety exists throughout corporate environments as well as in traditional educational environments. This anxiety manifests itself in many ways, including computer avoidance, embarrassment, bewilderment, trepidation, hesitancy and displeasure with the computer in general (Morgan, n.d.) The prevalence of computer anxiety is reported at different levels, depending on the environment or case example. The ranges of computer anxiety levels reported are:

(1) "Feelings of anxiety toward computers and computer use, is common, affecting between 30 and 40% of the population" (Orr, n.d.).

(2) "Some teachers and nearly all the learning support staff displayed aspects of 'computerphobia'" (Edmonson, n.d.).

(3) "…essentially everyone is feeling stressed out by technology" (Rosen, n.d.).

(4) 85% of adults have some level of discomfort around technology. In work setting, two-thirds of people are hesitant about technology (Goldsborough, n.d.).

(5) "…the overwhelming majority of the students enter the class with "enormous" computer anxiety." (Latimore, 1996).

This anxiety leads to a reduction in the effectiveness of training in teaching environments, thus negatively impacting education and workplace performance. Computer anxiety discouraged computer use, affecting students' academic progress, and lowers performance in business settings and ultimately affects career opportunities. (Orr, n.d.; Desai, 2001).

These three elements, taken together, demonstrate the problem that educators have in presenting and/or developing computer training. The use of computers is expanding in the workplace and in education. With this expansion of use, computer anxiety expands along with it, and with the anxiety, comes lowered performance in the classroom and in the workplace.

An additional problem revealed in the research is that the lexicon used in describing pedagogical methods is extensive and varied. Terms such as "self-paced" (Baldi, 1997), "self-directed" (Campbell and Wabby, 2003), and "opportunities to practice" (Rakes, 1989) are used interchangeably. For this reason the classifications of pedagogical methods, based on Kolb and presented by Harb and Terry (1982), is used (see Appendix B). This classification method categorizes a defined list of pedagogical methods into the four quadrants of the Kolb Learning Cycle (see Appendix A), which focus on aspects of experiential learning. Harb and Terry approach the Kolb Learning cycle by simplifying and further explicating Kolb's four quadrants.

The four quadrants of the learning cycle, as defined by Kolb (1984), are described in a variety ways, depending on the source. The following table demonstrates some of the lexicon used:

Table 1: Kolb Quadrant Definition

	Quadrant 1	Quadrant 2	Quadrant 3	Quadrant 4
Kolb (1984)	Concrete Experience	Reflective Observation	Abstract Conceptualization	Active Experimentation
Swenson (n.d.)	Experiencing	Reflection	Conceptualization	Planning
Lewin (n.d.)	Concrete Experience	Reflection	Abstract Conceptualization	Active Participation
Juch (1983)	Doing	Sensing	Thinking	Addressing
Harb and Terry (1992)	Why	What	How	What If

Swenson (n.d.) provides the following description of Kolb's four quadrants.

> **"Experiencing** or i*mmersing oneself in the "doing"* of a task is the first stage in which the individual, team or organization simply carries out the task assigned. The engaged person is usually not reflecting on the task as this time, but carrying it out with intention. **Reflection** involves stepping back from task involvement and *reviewing what has been done* and experienced. The skills of attending, noticing differences, and applying terms helps identify subtle events and communicate them clearly to others. One's paradigm (values, attitudes, values, beliefs) influences whether one can differentiate certain events. One's vocabulary is also influential, since without words, it is difficult to verbalize and discuss ones perceptions.

Conceptualization involves i*nterpreting the events* that have been

noticed and *understanding the relationships* among them. It is at this stage

that theory may be particularly helpful as a template for framing and

explaining events. One's paradigm again influences the interpretive range

a person is willing to entertain.

Planning enables taking the new understanding and translates it into

predictions about what is likely to happen next or *what actions should be*

taken to refine the way the task is handled."

Harb and Terry provide another way of explicating Kolb's four quadrants, in a

discrete list that sub-categorizes different teaching techniques into the four

described quadrants. They use a set of primary categories titled why, what, how

and what if. The researcher uses this set of categories and sub-categories by

Harb and Terry as a coding structure to review the pre-selected cases, as a way

to provide a consistent lexicon of terms.

CHAPTER II – REVIEW OF REFERENCES

This section describes the major references used in the study, in an annotated

form. The criteria used in including these references are (1) the relevance of the

reference to this study, (2) how well the reference supports a major section of

this study and (3) the credibility of the reference.

Each annotation, listed alphabetically by author, is organized by first listing the

formal reference, followed by a summary of the reference that relates the

reference to the Purpose Section and/or the Problem Statement of this study.

Next, the annotation describes specifically how the reference supports this study,

such as the Data Analysis section, or the Purpose Statement. Finally, the

annotation describes the criteria used in determining the credibility of the

reference.

Atkinson, S. (2004). A comparison of Pupil Learning and Achievement in Computer Aided Learning and Traditionally Taught Situations with Special reference to Cognitive Style and Gender Issues*. Educational Psychology, 24* (5) 662-664.

This study, done in 2004 in the United Kingdom, is a small-scale study performed

on 27 boys and 22 girls in the 10th grade. The Atkinson study is germane to this

study for two reasons. First, it addresses gender as it relates to learning and

achievement in computer-aided learning. Second, it addresses cognitive styles

and the impact they have on computer learning. While cognitive style is

specifically excluded from this study, it is worth noting that Atkinson makes a strong case supporting the role of cognitive style in determining student success in computer learning. The Atkinson study demonstrates the breadth of the topic of cognitive styles and was therefore used in framing the limitation not to include cognitive styles as a factor when analyzing successful teaching techniques in this study.

More relevant to this study are the data that Atkinson presents in relation to gender. Atkinson compares boys and girls test scores in a traditional teaching environment and in a CAL (computer aided learning) environment. Her data indicates that there are distinct differences on how boys and girls respond to traditional learning techniques and CAL techniques.

The Atkinson study supports this study in that it provides hard data concerning the gender issue as it relates computer training, supporting the idea that teaching methods do play a role when developing training targeted for male and female students. These data are used directly in the data analysis portion of this study.

The criteria used in selecting this study are; (1) the depth and detail that the author provides in the study; (2) the pedigree of the publication in which it was published (Educational Psychology) and (3) the relevance to this study regarding computer based teaching methods as they relate to gender. In addition Dr

Atkinson is an Academic Consultant for the University of Sunderland, in the United Kingdom.

Campbell, R. and Wabby, R. (2003). The Elderly and the Internet: A Case Study. *Internet Journal of Health, 3* (1).

The Campbell and Wabby study is one of the four pre-selected case examples presented in this study. It specifically addresses two aspects of this study, computer anxiety and age. It is an original case study involving 28 subjects over the age of 65 who are given a five-week training class on the use of the Internet. The training was conducted in 2003 and located at a large suburban Pittsburg public library.

As a case example, the Campbell and Wabby study directly support the data analysis portion of this study. Specific pre-training test, post-training test, surveys and interviews presented by Campbell and Wabby are used in the data presentation of the case example.

The criteria used in selecting this case example are that the study specifically addresses two of the components of this study (1) computer anxiety and the older adult and (2) how to minimize that anxiety to support successful training. In addition, Campbell received his Masters of Library Science from the University of Pittsburgh and is a Doctor of Education in Instructional Design and Technology. University of Pittsburgh. Currently Dr.

Campbell is an Assistant Professor, Department of Health Management

System at Duquesne University.

Comber, C., Colley, A., Hargreaves, D. and Dorn, L. (1997). The effects of age, gender and computer experience upon computer attitudes. Educational Research, 39 (2) 123-133.

This study demonstrates how age, gender and previous computer experience

impacts computer attitudes among 278 secondary school pupils. Comber et al.

identifies the differences in computer attitudes between males and females,

taking into account the age of the participants and the previous computer

experience of the participants. Comber et al. found that boys and girls have

different attitudes about computers at different ages and that they also have

different attitudes about computers depending on their previous exposure to

computers.

The study provides data for the conceptual analysis portion of this study. It

directly supports the topics of age, gender and previous computer exposure

described in the significance portion of this study.

The criteria used in selecting this study are that the study directly addresses the

issues raised in the problem statement of this study, specifically age, gender and

previous computer exposure. Dr. Comber has recently presented in 11

conference papers related to education in the United Kingdom. Dr. Hargreaves

is well published in England, in prestigious journals such as the British

Educational Research Journal and the Cambridge Journal of Education. In

addition, the publication in which the article is published (Educational Research)

is an established and well-respected journal in its field.

Desai, M (2001) Computer Anxiety and Performance: An Application of a Change Model in a Pedagogical Setting. *Journal of Instructional Psychology, 28* **(3) 141-149.**

This study, begun in 1997 and concluded in 1999, examines computer anxiety

and performance among students in an introductory course in business at

Indiana University. The reference is applicable to this study in that it provides

data supporting the definitions and traits of computer anxiety. The study applies

a "change model" based on the work by educational psychologist Kurt Lewin

(1952) which essentially follows this course: (1) unfreeze current condition, (2)

apply wanted change and then (3) refreeze the new condition. This change

model, addressing a system of managed learning, is not fully explained in the

study, and therefore that portion is ignored. The data that are relevant are in the

form of qualitative measurements of computer anxiety based on interviews

before, during and after the classes. A Likert type scale was used to measure

three degrees of responses: "never", "sometimes" and "usually", with values of 1,

2 and 3 respectively. While the article doesn't provide the actual data, it does

provide a summary of the results.

This study directly applies to the data analysis portion of this study, specifically

defining and describing computer anxiety in an education setting. It also is

applicable to the problem statement in that it demonstrates how computer anxiety

plays a role in the educational environment.

Criteria used in including this study include the pedigree of the publication,

Journal of Instructional Psychology and the by the academic standing of the

author, Dr. Mayur Desai, tenured Assistant Professor of Management Information

Systems, Indiana University. In addition, the author is referenced in other related

studies, specifically Morgan (1997).

Desai, M. and Richards, T. (1999) End-user training: A meta model. *Journal of Instructional Psychology, 26* (2) 74-85.

The Desai and Richards study is one of the four pre-selected case examples

presented in this study that specifically addresses the impact of training delivery

techniques for the end user. The case study was performed on an unspecified

number of employees of a Fortune 100 corporation located in a major

southwestern city in the United States.

This case example provides an argument used in the Problem Statement for the

need for computer literacy as critical to the success of individuals in the

workplace and their employers. In addition, this case example provides data, of

a qualitative nature, for the second part of the study, the narrative descriptions of

case examples where training methods are examined.

Criteria used in including this study are the pedigree of the publication, Journal of

Instructional Psychology and the by the academic standing of the author, Dr.

Mayur Desai, tenured Assistant Professor of Management Information Systems,

Indiana University.   In addition, the author is referenced in other related studies,

specifically Morgan (1997).

**Graff, M., Davies, J., and McNorton, M. (2004). Cognitive Style
and Cross Cultural Differences in Internet Use and Computer
Attitudes. Retrieved April 22, 2004 from
http://www.eurodl.org/materials/contrib/2004/Graff_Davies_McN
orton.html**

This case study, performed in 2004 on 103 college students in China and the

United Kingdom, focuses on cultural differences in computer anxiety (explicitly

ignored as described in Limitations) and the effects of gender on computer

anxiety.

This case study is relevant to this study in that it provides quantitative figures

describing how gender plays a role in determining computer anxiety, which is

used directly in the data analysis of part one of this study.

The criterion used in selecting this study is the relevance of the how gender plays a role in computer attitudes. Dr Graff, has published over 13 articles since 2000 pertaining to learning, theories, developmental psychology and education. In addition, Dr. Graff is an executive member of The European Learning Styles Information Network, member of Editorial Review Board for AACE/SITE Journals, reviewer for Behavior and Information Technology and a reviewer for The Journal of the European Association for Research on Learning and Instruction. Maggy McNorton has been Associate Head of the School of Humanities and Social Sciences for the University of Glamorgan since 1998.

Harb, J. and Terry, R. (1992). Teaching Through the Cycle: Application of Learning Style Theory to Engineering Education at Brigham Young University. Retrieved May 11, 2005 from http://www.et.byu.edu/~jharb/enged.html#monogr

This monograph by Dr John Harb and Ron Terry provides the foundation in this study for defining and describing pedagogical methods and how they can be categorized into the Kolb Learning Cycle. This paper goes into great detail and discussion each of a group of pedagogical methods described and how each is placed into the appropriate category.

This reference is used directly in the data analysis portion of this study. The methods described in the monograph are matched to the pedagogical methods as presented in each case example profiled in part two of the study. The pedagogical method is then categorized into Kolb's Learning Cycle for analysis.

The criteria used in selecting this reference are the credentials of the main author, Dr. John Harb. Dr. Harb received his B.S. from Brigham Young University in 1983, received his M.S. from the University of Illinois in 1986 and received his Ph.D. from the University of Illinois in 1988. Dr Harb has been actively involved in engineering education for the past several years and has written a textbook for a new introductory course in chemical engineering designed for first-year students. The monograph referenced extensively investigates the Kolb Learning Cycle, a highly regarded theory on learning styles and methods written by David Kolb. Kolb's model of experiential learning can be

found in many discussions of the theory and practice of adult education, informal

education and lifelong learning.

Latimore, R (1996) Replacing the Novice Computer User's Anxiety with Confidence. Retrieved April 10, 2005 from http://makahiki.kcc.hawaii.edu/tcc/tcc_conf96/latimore.html

This case study was performed on college level students over a six-semester

period. The number of students each semester varied from 8 to 30, depending

on the semester. The main purpose of the study was to determine if the authors'

pedagogy was successful in increasing test scores among anxious students.

As a case example, the Latimore study provides data for analysis in part two of

the conceptual analysis portion of this study. In addition, the Latimore study

provides qualitative data describing computer anxiety and how it affects students'

performance, referenced in the purpose section of this study.

Criteria used in selecting this reference include the level of statistical analysis

done on test results in determining if the methods were successful and because

the study's' relevance. The Latimore case example ties both computer anxiety

and a pedagogical method used to reduce the anxiety and increase test scores.

Ritchie R. Latimore, Assistant Professor, School of Technology has taught at

Kent State University for over 15 years. Kent State University has been a leader

in academic excellence since it's founding in 1910.

**Morgan, (n.d.) Computer Anxiety: A Survey of Computer
Training, Experience, Anxiety, and Administrative Support
Among Teachers. Retrieved April 6, 2005, from
http://oas.ucok.edu/OJAS/97/T97/AMORG.HTM**

The Morgan reference, written 1997, is a case study that attempts to determine

the causes of computer anxiety in a high school environment. The analysis and

results of this reference are weak in that little supporting documentation is offered

in the analysis portion of the study. However, the first portion of the reference is

a literature review, focusing on computer anxiety and is rich in cited definitions

and references.

This reference is used in providing descriptions of how computer anxiety

manifests itself in high school students. These descriptions are used in the

Purpose sections of this study, providing foundation descriptions of what and

how computer anxiety manifests itself.

The criteria used in including this reference in the study are the high level at which the definitions and descriptions are cited. The citations offered include others in the field that this study also utilizes, namely Igbaria and Chakrabarti (1990) and Desai (1986).

Mosner, E., Spiezle, C. & Emerman, J. (2003) The Convergence of the Aging Workforce And Accessible Technology. The Implications for Commerce, Business and Policy. Retrieved April 23, 2005, from http://www.microsoft.com/enable/aging/demographics.aspx

This article addresses the aging workforce in the United States and the implications of that aging workforce on commerce and industry. It is rich in data that supports the assertion that the number of older workers is increasing and that these older workers will have a significant impact on industry and commerce. This impact takes the form of increased needs for computer competency among workers and the need for businesses to provide the training needed by these workers.

The Mosner paper is included in this study because it contributes directly to the Purpose section and the Problem statement in that supports the assertion the workers are getting older and that their impact on the workplace will be significant. Anecdotal data are given demonstrating how older workers use computers and quantitative data are given in tabular and chart for, breaking down the populations of workers in America by age group,

The criteria used in selecting this paper include the publisher, Microsoft Corporation and the sources of the statistical information presented which include the U.S. Bureau of Labor Statistics, the Bureau of Labor Statistics, the Equal Employment Opportunity Commission, the US department of Labor and the US Department of Justice.

Orr. L (n.d.) Computer Anxiety. Retrieved April 6, 2005, from http://www.usm.maine.edu/~com/lindap~1.htm

This reference is a primer on computer anxiety developed for a college class at the University of Southern Maine, Communication 499. It is a literature review examining the prevalence of computer anxiety, the forms of that anxiety and the pedagogical methods used in mitigating the anxiety.

The paper supports this study in that it provides definition of (1) computer anxiety and (2) the ways that the anxiety presents itself.   While not used as a case example, the paper also provides collaborative qualitative data in suggesting ways to mitigate the affects of computer anxiety.

The criteria used in deciding to use the reference are the sources cited in the paper, including Gressard and Loyd (1986), Igbaria and Chakrabarti (1990), both of which are cited by this study and by other authors in the field of computer anxiety.

Rakes, Susan B. (1989) Computer Anxiety. *Training and Development Journal, August* 25-29*.

The Rakes reference is a journal article published in the Training and Development Journal, 1989. Its purpose is to provide methods for educators to use when teaching computer adult education classes. While dated, the article provides a relevant checklist of twenty items that suggest how to avoid computer anxiety. The article cites Stephen Brookfield's' *Understanding and Facilitating Adult Learning* as the source of the checklist.

As one of the four pre-selected case examples, the article supports part two of the conceptual analysis in this study, in that it provides a list of pedagogical techniques used to mitigate the affects of computer anxiety among adult students. The article presents the twenty items in a prose form with no statistical backing on the effectiveness of the techniques recommended.

Although the article is devoid of any supporting data addressing the effectiveness of the recommendations, the source of the checklist cited by the author lends credibility to this article. The cited author of the checklist, Stephen Brookfield, Ph.D., distinguished professor, University of St. Thomas; Ph.D., Adult Education, University of Leicester; M.A., Sociology, University of Reading; B.A., History, Politics, Coventry University. Dr Brookfield has written numerous articles on adult learning and the pedagogical methods used when training adults.

Smith, M & Kotrlik, J. 1990. Computer Anxiety Among Extension Agents. *Journal of Extension. 28* **(4) 1**

This short article was written for the Journal of Extension, a publication devoted to issues related to extension agents. This specific article addresses the problem of extension agents, their level of computer anxiety and the ramifications on the extension service of that anxiety. While the article focuses on a small sector of users (extension agents in 11 states) it is assumed by this researcher to be useful to apply the data presented to the population as a whole.

The article supports this study in the purpose section by providing collaborative definitions of computer anxiety. In addition, it supports the problem statement by providing statistical data on how prevalent computer anxiety is in the workforce, albeit a small sample. Nevertheless, the data provided are relevant to the larger problem of computer anxiety in the workplace.

The criteria used in including this reference is that the article focuses in on a very specific segment of computer users (extension agents), examining the level of anxiety among the users and the affects of that anxiety. This specificity provides an in-depth look at a specific industry, instead of a generalized broad-brush examination shown elsewhere in this study.

CHAPTER III – METHOD

The research method chosen for this study is literature review. This methodology, as described by Leedy & Ormrod (2001) was chosen because its approach to collecting, evaluating, analyzing, and organizing literature in order to conduct the study. A qualitative approach is used because it allows the researcher to describe, explain, explore and interpret the data as it is discovered. The subjective nature of computer anxiety makes this method ideal for this study.

In Part One of the study, content analysis (Palmquist et al., 2005) is used to identify and organize the reasons behind computer anxiety. Content analysis is selected as the best approach to data analysis because, as stated by Palmquist et al. (2005), "Researchers quantify and analyze the presence, meanings and relationships of such words in concepts, then make inferences about the message within the texts, the writer(s), the audience, and even the culture and time of which these are a part." In this case, using this approach supports design of an analytic plan that allows loose generalization of the terms synonymous with computer anxiety. In Part Two, the researcher presents a one to three-page profile of each of the four pre-selected case examples of successful computer-based training, designed to mitigate existing computer anxiety. Profiles examine a standardized set of categories of information in each case example, reviewing: the resource bibliographic citation; the educational setting; the frequency/duration of the training; the student population; the instructional goals; the pedagogical methods used; the measurement approaches used to determine "success" in

relation to mitigating computer anxiety; and the categories of reported computer

anxiety successfully addressed.

Literature Collection

The data for the study is primarily gathered from the following sources:

General web searches using the search engines found at these URL's:

- o www.google.com

- o www.yahoo.com

- o www.altavista.com

- o www.dogpile.com

Database and Index searches were conducted using the University of Oregon's'

Library System. The specific databases are:

- o PsycInfo

- o ArticleFirst

- o Academic Search Premier

- o Psychology & Behavioral Sciences Collection

- o Computer Source

- o Web of Science

- o CiteSeer

Terms used in doing the general web searches and database/index searches are (ranked by usefulness to the study):

- o Computer anxiety

- o Computer stress

- o Anxious computer users

- o Barriers to computer learning

- o Computer pedagogy

- o Computer training

- o Psychology and computers

- o Computerphobia

- o Anxiety

- o Technophobia

These search terms provided a wide variety of literature that spanned many disciplines. These include educational psychology (Atkinson 2004; Desai 2001), educational gerontology (Baldi, 1997), health (Campbell and Wabby, 2003), instructional psychology (Desai and Richards 1999), industrial publications (Bisworld n.d.), teaching methodologies (Edmonson, n.d.) and information technologies (Igbaria and Chakrabarli, 1990). Since there are such a wide variety of literature and disciplines, the researcher used conceptual content analysis techniques to classify and codify the literature into common classifications based on initial and emergent terms/concepts within the literature. These emergent terms/concepts, not initially thought of at the inception of the research, are added because of their prevalence and frequency when the searches of the initial

search terms are conducted. Examples of these emergent terms/concepts are "Online Phobia" (Joseph & Stone, 2005) and the feeling that the student will "… break the computer". (Morgan, n.d.)

Data Analysis

The data collected are analyzed using the content analysis strategies defined by Palmquist (2005).   Following Palmquist's model of conducting a conceptual analysis, these eight questions/steps are used to support the conceptual analysis for Part One of the study – identification of characteristics of computer anxiety:

1. Level of Analysis.

    a. Word phrases concerning "characteristics of computer anxiety", as opposed to single words are to be coded. Phrases like "computer anxiety", "computer stress", "apprehension about computers", "difficult to use", are coded similarly.

2. How Many Concepts

    a. Building on an initial pre-defined set of words and phrases concerning "characteristics of computer anxiety", an interactive approach was used in coding. This was done to allow the researcher to add similar concepts to the analysis as needed. The initial number of concepts was limited to a set of four: (1) Computer Anxiety, (2) Computer Phobia, (3) Technophobia, (4) Fear of computers

3. Existence or Frequency

    a. Terms and phrases concerning "characteristics of computer anxiety" are coded for existence in the selected texts – not for frequency. This is done because the study is interested in how many kinds of concepts, related to computer anxiety, appear in the selected literature.

4. How to Distinguish Among Concepts.

    a. A loose level of generalization is used when coding concepts. For example, the terms "Computer anxiety" and "Computerphobia" are determined to be one and the same. The initial loose generalizations used are:

        i. Computer Anxiety

            1. Computer Anxiety

            2. Computer Phobia

            3. Technophobia

            4. Fear of computers

            5. Stress

            6. Apprehension

            7. Negative perception

            8. Negative attitude

5. Rules for Coding Text

   a. Using the coding generalizations listed in Step #4, the text is translated using the high level category of the generalization as the primary category. For example, in 4-i above, "Computer Anxiety" is the larger category with all the subordinate terms revealed through the conceptual analysis, and presented beneath it. In this case, computer phobia, technophobia and fear of computers are all categorized as subordinate categories under the larger category, "Computer Anxiety". Stress, apprehension, pressure, negative perception and negative attitude are all subordinate categories under the larger category "Stress".

6. Irrelevant Information

   a. Information contained in the texts that provide no extra concept or value to a phrase is ignored. For example, in the phrase "Fear of the Computer", the "…of the…" is ignored as it provides no additional meaning to the phrase. The resultant phrase, "Fear Computer" is generalized as "Computer Fear".

7. Coding the Texts

   a. The coding of the texts is entered directly into a Microsoft Access Database for easy sorting and retrieval. The original sets of phrases (computer anxiety, computer literacy, stress, training, teacher, elderly) are entered as major phrases, with subordinate phrases coded as a subset of the major phrase. When similar

terms are encountered, they are grouped together as one. Terms treated as identical are:

1. Computer phobia – Computerphobia
2. Online Phobia - Computerphobia
3. Fear of Computers – Computer Fear
4. Technostress – Technophobia
5. Reluctance – Hesitancy
6. Less liking – Negative attitude

b. When relevant ancillary terms are encountered, they entered as they emerge.

8. Analysis

a. The researcher then analyzes the data collected and organizes it into the previously defined categories. For part one of the study, the data concerning characteristics of computer anxiety is categorized by:

i. Age

ii. Gender

iii. Instructional method

iv. General psychological factors

v. Previous exposure to computers

Part Two of the study examines four pre-selected cases; each presenting a different computer-based training strategy that successfully addresses some aspect of computer anxiety. Each pre-selected case is analyzed independently and presented in a standardized summary profile format. The format is designed show the similarities and differences between each of the case examples. No two case examples are identical in scope or mission, so by using this standardized format, each study is evaluated not only independently on it's own, but it also allows for comparison between the case examples. This format also allows the educator to apply the concepts of an individual example to their own particular environment. For example, the case example "Training the elderly to become self-sufficient on the Internet to learn more about health issues (Campbell and Webb, 2003)" and the example "Training older adults to use computers in the workplace (Baldi, 1997)" may be appropriate for the educator tasked with developing a training methodology for elderly students, but would prove less useful for a primary grade instructor.

In determining the pedagogical methods that are used in each case example, Harb and Terry's (1992) definitions, as they apply to the four quadrants presented in the Kolb Learning Cycle, are used. (see Appendix A). Each of the four quadrants describes a step that students precede through when learning new material. Originally based on Lewins' (1952) work, it describes the following learning cycle: "**Concrete Experience** is followed by **Reflection** on that experience on a personal basis. This may then be followed by the derivation of

general rules describing the experience, or the application of known theories to it

(**Abstract Conceptualization**), and hence to the construction of ways of

modifying the next occurrence of the experience (**Active Experimentation**),

leading in turn to the next **Concrete Experience"** (Atherton, paragraph 2, 2004).

Harb and Terry reinterpret this process by defining the steps in the cycle as

"Why" (Concrete Experience), "What" (Reflection), "How" (Abstract

Conceptualization) and "What If" (Active Experimentation). Harb and Terry

extend their analysis of the Kolb Learning Cycle by codifying pedagogical

techniques. The four pre-selected case examples are analyzed and categorized

into one of the four quadrants using the pedagogical techniques listed by Harb

and Terry (1992) in Appendix B.

Data Presentation

Data resulting from the conceptual analysis conducted in support of Part One of this study are presented in a table (see Table 2) of terms, classified as characteristics of computer anxiety. Then, characteristics are framed and aligned with each of the pre-defined sources of computer anxiety, (age, gender, instructional method, general psychological factors and previous exposure to computers) and tied to the source literature, as demonstrated in the template below (see Table 2). A reference number indicating the source designates whether or not the source of the computer anxiety is reported as being present in the characteristic. Discussion of the terms and the significance of each of the characteristics follows the tabular presentation.

Sources of Computer Anxiety					
Characteristics of Computer Anxiety	Age	Gender	Inst Method	Psy Factor	Previous Exposure
Charac. #1					
Charac. #2					
Charac. #3					

Table 2: Template for aligning characteristics of computer anxiety to the reported sources of that anxiety.

The outcome for Part Two of the study is presented in the form of a one to three-page summary profile of each of the four pre-selected cases. Criteria addressed in each summary profile include:

- The bibliographic information for each case (the citation).

- The educational setting for each case.

- Frequency/duration of the training.

- The student population in each case.

- The instructional goals in each case.

- The pedagogical methods used in each case, codified into Kolb Learning Cycle categories (Kolb, as cited by Harb and Terry, 1992)

- The measurement approaches used in each case to determine "success" in relation to mitigating computer anxiety.

- The categories of reported computer anxiety successfully addressed in each case.

- A summary of the case example.

CHAPTER IV – ANALYSIS OF DATA

Selected literature is reviewed using content analysis as described by (Palmquist et al., 2005). Analysis has three main goals: (1) To identify the sources of computer anxiety, (2) to describe the characteristics of computer anxiety, and (3) to present case examples of demonstrating successful teaching strategies to address computer anxiety. The analysis is conducted in two stages. Stage One, presented in tabular form, addresses the literature in the area of the sources of computer anxiety, and is designed to identify characteristics of computer anxiety. These characteristics are defined by the following selected sources: (a) age (Baldi, 1997), (b) gender (Solvberg, 2002), (c) instructional method (Goldsborough, 2002), (d) general psychological factors (Galagan, 1983) and (e) previous exposure to computers (Loyd and Gressard, 1984).   Table 2: Characteristics and Sources of Computer Anxiety, presents the results of the Stage One coding process. Table 2 aligns the characteristics of computer anxiety with the selected sources of this anxiety.   Stage Two of the data analysis, presents four case examples that demonstrate successful teaching strategies to address computer anxiety, presented in one to three-page summary form.

Stage One of Data Analysis: Content Analysis

Table 2: Characteristics & Sources of Computer Anxiety
Sources of Computer Anxiety

Category	Age	Gender	Inst Method	Psy Factor	Previous Exposure
Computer Anxiety	1	1,2,3	4	1,5,6	1
Computer Phobia				7	
Technophobia				8	
Fear of computers	8,10		4		
Stress			11	8,12	11
Apprehension			4		
Negative Perception	10	2			
Negative Attitude			13		3
Characteristics of computer anxiety, revealed through content analysis					
Distrust	9				
Less Confidence		2,3			
Resistance	9				
Hesitancy	10			7	10
Unable	8				
Unwilling				5	
Fear of Breaking	10				
Avoidance				6	
Uncertainty			4		

1. Morgan, 1997
2. Abler & Sedlacek, n.d
3. Comber, et al, 1997
4. Latimore, 1996
5. Smith & Kotrlik, 1990
6. Orr, n.d.
7. Goldsborough, 2002

8. Campbell & Wabby, 2003
9. Joseph & Stone, 2005
10. Baldi, 1997
11. Desai and Richards, 1999
12. Desai, 2001
13. Atkinson, 2004

Key: Reference Numbers for Table 2

Discussion of Table 2: Characteristics & Sources of Computer Anxiety

As shown by Table 2, the characteristics and sources of computer anxiety are varied. By using the initial set of search terms, (Computer Anxiety, Computer Phobia, Technophobia, Fear of computers, Stress, Apprehension, Negative perception, Negative attitude) many new terms emerged. The second set of terms includes distrust, less confidence, resistance, hesitancy, unable, unwilling, fear of breaking, avoidance and uncertainty. The following table (see Table 3) summarizes the number of instances a particular characteristic was identified with one of the five sources of computer anxiety.

Table 3: Summation of the number of references by source

Sources of Computer Anxiety					
	Age	Gender	Inst Method	Psy Factor	Previous Exposure
Number of references	9	6	6	10	4

Stage Two of Data Analysis: Summary Profiles

Stage Two of the data analysis is designed to present summary profiles of four

pre-selected cases, each of which provides an example of a successful

instructional method designed to address and/or mitigate computer anxiety. The

four pre-selected cases examined are:

- o Training the elderly to become self-sufficient on the Internet to learn more

  about health issues (Campbell and Wabby, 2003).

- o Training teachers to replace the anxiety of a student with confidence

  (Latimore, 1996).

- o Designing instructional guidelines for teachers to use when developing

  computer-training methodologies (Rakes, 1989).

- o End-user training: a meta model (Desai & Richards 1999).

Each of four pre-selected case example is analyzed and presented in the form of

a one to three-page summary profile. Criteria addressed in each summary

profile include:

- o The bibliographic information for each case (the citation).

- o The educational setting for each case.

- o Frequency/duration of the training.

- o The student population in each case.

- o The instructional goals in each case.

- o The pedagogical methods used in each case, codified into Kolb Learning

  Cycle categories (Kolb, as cited by Harb and Terry, 1992)

- o The measurement approaches used in each case to determine "success" in relation to mitigating computer anxiety.

- o The categories of reported computer anxiety successfully addressed in each case.

- o A summary of the case example.

Of particular interest to this study is the criterion "Pedagogical methods", because each of these cases is an example of an instructional encounter successfully designed to address and mitigate computer anxiety. Pedagogical methods are described in various manners. This study uses the categorizations and definitions based on a set of definitions provided by Harb and Terry (1992). Harb and Terry use the Kolb Learning Cycle (see Appendix A) to categorize different pedagogical teaching techniques into four areas. The fours areas are: **Why**, referring to teaching techniques that address the introduction of the subject; **What**, referring to teaching techniques that provides information to the students that allow them to organize and integrate new material; **How,** referring to teaching techniques that address the mechanics of applying the material; and **What if,** referring to teaching techniques that provide opportunity for self-discovery and for the student to evaluate performance. A determination of teaching techniques in each of the pre-selected cases follows the guidelines set by Harb and Terry (1992) (see Appendix B).

A summary of each case example is presented at the end of each case profile, with emphasis on identifying the techniques that the case describes. These

techniques should provide educators in the field of computer-based training with tools applicable to their particular educational setting.

Case Example #1 - Training the elderly to become self-sufficient on the Internet to learn more about health issues (Campbell and Wabby, 2003).

- *Educational setting:* A large suburban Pittsburgh Public Library sponsored a series of Internet training seminars and made their resources available to the research team. These resources included a meeting room and use of Internet accessible computers. Each session began with an overview of the day's topic, followed by hands-on instruction and practice.

- *Frequency/duration of the training:* The sessions were five weeks in length, meeting once a week for two hours for a total of 10 hours of instruction.

- *Student population:* All students (n=28) were aged 65 and older. Eight participants were male, and twenty were female. The majority of the participants had used a computer before training. Thirty-nine percent had a college degree and twenty-eight percent had some post-graduate training. Eight-two percent were retired.

- *The instructional goals:* To investigate the impact of training the elderly to use the Internet in order to become more active in their health care.

- *Pedagogical methods:* The authors reported using constructivist teaching techniques and self-directed learning. Each lesson was presented using a different method for engaging the participant to find medical information that was relevant to their individual needs. A short presentation was made using a laptop and LCD projector. Seniors where shown how to search several web sites containing pharmaceutical

information, and then given a chance to practice searching those sites using a computer connected to the Internet. To facilitate learning, a course workbook was provided to the participants to serve as a reference for future use. When analyzed in terms of categories provided by Harb and Terry (1992), the following picture of Case #1 emerges:

- Kolb Quadrant #1 – *Why? (The concrete experience)*
    - Formal Lecture, feeling tone
    - Interactive Learning
    - Class discussion
    - Group Discussion
- Kolb Quadrant #2 – *What? (Techniques for reflection)*
    - Lecture with Visual Aids
    - Demonstration by Instructor
    - Problem Solving by Instructor
- Kolb Quadrant #3 – *How? (The ways to promote abstract conceptualization)*
    - Lectures with Demonstration
- Kolb Quadrant #4 – *What if? (The techniques for active experimentation)*
    - Training
    - Open-ended laboratories
    - Group discussion

- o *Measurement approaches used in each case to determine "success" in relation to mitigating computer anxiety:* Interviews, surveys and questionnaires were used to determine the effectiveness of the training.

- o *Categories of reported computer anxiety successfully addressed:* In the general category of computer anxiety, the authors reported a lowering of the feeling of hesitancy, lowering the participants' reluctance to use a computer. Increased feeling of computer literacy and a general increase in the level of comfort by the user was reported.

- o *Summary of case example:* The results of the case example indicate that constructivist, self-directed techniques are appropriate and successful in teaching older adults. By providing instruction to older adults on how to use a computer to locate health information on the Internet, negative feelings toward the use of the computer along with barriers such as the lack of technical and software skills may be reduced, which can lead to lower feelings of anxiety and higher feelings of efficacy.

Case Example #2 - Training teachers to replace the anxiety of a student with confidence (Latimore, 1996).

- o *Educational setting:* The study was done at Kent State University, Geaugu campus, Burton, Ohio.

- o *Frequency/duration of the training:* Unknown. Since the study was performed at Kent State University and is assumed to follow typical university term lengths, either semester or quarter. Six different terms were studied.

- o *Student population:* Since the case was performed in a University classroom setting, the student population varied each term.
  - o Fall 1993   n=30
  - o Spring 1994   n=24
  - o Fall 1994   n=28
  - o Spring 1995   n=21
  - o Fall 1995   n=8
  - o Spring 1996   n=20

- o ***The instructional goals:*** To help eliminate the "anxiety" and uncertainty experiences by Introduction to Computer students.

- o ***Pedagogical methods:*** The author uses a method he calls Performance Objective Domains, (POD). This technique requires each student, on a rotating basis, to actually operate the computer while the lecturer simultaneously lectures on the application or system software utilized in the course.

  - o Kolb Quadrant #1 – *Why? (The concrete experience)*

    - ▪ Interactive Learning

    - ▪ Formal Lecture – feeling tone

  - o Kolb Quadrant #2 – *What? (Techniques for reflection)*

    - ▪ Lecture with Visual Aids

  - o Kolb Quadrant #3 – *How? (The ways to promote abstract conceptualization)*

    - ▪ Example Problems Worked on by Students

    - ▪ Lectures with Demonstrations

  - o Kolb Quadrant #4 – *What if? (The techniques for active experimentation)*

    - ▪ Student Presentations

    - ▪ Role Playing

o *Measurement approaches used in each case to determine "success" in relation to mitigating computer anxiety:* Test scores were used in determining the effectiveness of the techniques applied. During the first three semesters, the POD's had not been incorporated into the teaching method. The application of the POD's occurred during the last three semesters.

o *Categories of reported computer anxiety successfully addressed:* General computer anxiety is the only category addressed by the author.

o *Summary of case example:* The results of the case example indicate that involving the student in the presentation of the material, specifically by having the student operate the computer while the instructor lectures, is an effective way to increase test scores among the students. The author assumes that increased test scores equate to a reduction in the students' computer anxiety, which was not established.

Case Example #3 - Designing instructional guidelines for teachers to use when developing computer-training methodologies (Rakes, 1989).

- *Educational setting:* The educational setting was not specified in the case. The only setting described is that the methods are applied at "Adult education classes".

- *Frequency/duration of the training:* Generally, classes are three days in duration.

- *Student population:* Adults, not specific.

- *The instructional goals:* The stated instructional goals are to alleviate computer anxiety so that students can learn the skills and transfer them to the workplace

- *Pedagogical methods:* This article presents a list of twenty techniques used to mitigate computer anxiety. Techniques listed include:

  - Kolb Quadrant #1 – *Why? (The concrete experience)*

    - Motivational Stories

    - Formal Lecture, feeling tone

    - Class Discussions

    - Group Discussion

    - Socratic Lecture

    - Interactive Learning

- o Kolb Quadrant #2 – *What? (Techniques for reflection)*

  - Lecture with Visual Aids

- o Kolb Quadrant #3 – *How? (The ways to promote abstract conceptualization)*

  - Guided Labs

- o Kolb Quadrant #4 – *What if? (The techniques for active experimentation)*

  - Open-Ended Laboratories

  - Role Playing

  - Brainstorming

- o ***Measurement approaches used in each case to determine "success" in relation to mitigating computer anxiety:*** Anecdotal reports.

- o ***Categories of reported computer anxiety successfully addressed:*** General computer anxiety is the only category addressed by the author.

- o ***Summary of case example:*** This article presents general techniques that the author has found to decrease computer anxiety among adult learners. Many of the techniques, such as being animated, appearing confident, coming prepared and being precise and clear can be applied to any teaching environment to decrease anxiety. However, other techniques such as on-hands workshop labs, open-ended laboratories and lectures with demonstration are specifically applicable to training on the computer.

Case Example #4 - End-user training: a meta model (Desai & Richards 1999).

- ○ ***Educational setting:*** The study was not specific in where it took place, however from the problem statement it's inferred that the educational setting was a business-training center.

- ○ ***Frequency/duration of the training:*** Not specified.

- ○ ***Student population:*** Four groups of students were used in the study. The study used self-described computer novices. The students were allowed to choose what group they were in. The choices were (1) Instructor Based Training (IBT) in Word, (2) Instructor Based Training in Excel, (3) Computer Based Training (CBT) in Word and (4) Computer Based Training in Excel.

- ○ ***The instructional goals:*** The stated instructional goals are to increase the effectiveness of training by using CBT methods as opposed to IBT methods.

- ○ ***Pedagogical methods:*** Specific pedagogical methods were not described in the study, however the effectiveness of CBT and IBT methods was measured. The IBT methods involved traditional lecture with instructor demonstration of the skills. Students were then allowed to try some exercises and could interact with the instructor as needed. The CBT training involved an unnamed commercial package that had no instructor. It is assumed that minimal instruction was given as to how to start the training, but it is clear that no instructor was present. Since the

specifics of the CBT training are not shared, it's difficult to classify CBT methods into the Kolb quadrants. The study was setup so that the CBT training was self-paced, so the only clear Kolb method was Open-ended Laboratories, from Kolb Quadrant #4 – *What if? (The techniques for active experimentation).*

o **Measurement approaches used in each case to determine "success" in relation to mitigating computer anxiety:** Interviews were conducted to determine how the participants felt about the training.

o **Categories of reported computer anxiety successfully addressed:** Stress was the only category of anxiety that was addressed in the study. Levels of stress were determined by interview.

o **Summary of case example:** This case has limited usefulness to this study since the pedagogical method used was not clearly defined. However it is useful to note that the conclusions that the authors provided show that there is no difference in outcome between IBT and CBT based training methods since both groups reported satisfaction in the style that they chose. The authors reported that the novices who had the least amount experience chose the IBT methods because they felt that they needed to be able ask for assistance (that they knew they would need). Conversely, the more experienced users chose the CBT because they were confident that they could get through the training more efficiently than with an IBT program.

CHAPTER V – CONCLUSIONS

The purpose of the study is to examine potential relationships between computer anxiety and ways of designing computer-based training in the workplace. The Conclusion of the examination is framed in two parts. Part One of the study, which is designed to identify and describe the variety of characteristics of computer anxiety, is discussed in two sections -- first a discussion on the *sources* of computer anxiety and second a discussion of the *characteristics* of computer anxiety. Part Two of the study, which is designed to examine four pre-selected case examples of computer training that are reported to be successfully designed to address and mitigate specific characteristics of computer anxiety, is summarized.

Discussion of the Sources of Computer Anxiety

Of the five identified sources of computer anxiety experienced by individuals first confronting computer-based training in the workplace (age, gender, instructional method, psychological factors, previous exposure and characteristics of computer anxiety), the predominant sources identified in the selected set of references analyzed in this study are age (nine references) and general psychological factors (ten references).

Psychological factors as a source of computer anxiety are the most difficult to interpret because the limitations of the study precludes further investigation into the specific psychological factors mentioned. Despite this, certain

conclusions can be drawn from the data, focused on the situation that the delineation between general anxiety and computer anxiety is blurry at best. Both Orr (n.d) and Morgan (1997) describe anxiety and computer anxiety in the same way. Their descriptions range from mild anxiety "May be slightly anxious or use some negative statements…" (Orr, n.d.) to severe "Exhibits the classic signs of an anxiety reaction… sweaty palms, heart palpitations, headaches." (Orr, n.d.). Morgan (1997) describes the computer anxious individual in general terms, making the connection between computer anxiety and general anxiety, which "… cause them to experience feelings associated with anxiety such as fear, embarrassment, disappointment, irritation, and frustration" (Morgan, 1997).

Age, while having the second highest number of instances of identifiable characteristics as a source of computer anxiety, also proves to be difficult to interpret. The age range under consideration in this study is those between 18 and 60 years of age, and those over 60. Clearly, from the data provided by Campbell and Wabby (2003), Baldi (1997), Joseph and Stone (2005) age does play a significant role in determining the level of and types of computer anxiety behaviors exhibited by older adults. However, the reasons for the higher propensity for anxiety among older adults remain elusive. Joseph and Stone (2005) make an argument that the lower income of seniors locks them out of home ownerships of computers and Internet access. Others such as Orr (n.d.) make a case that the reason behind the higher levels of anxiety

among older adults is simply a matter of familiarity. Orr's reasoning is that younger generations have grown up with computers in the home, at school and currently even in their cars. Older adults (those over 60) didn't have these things in their homes as they grew up. For some in this age group, the computer presents itself as something new and foreign.

Gender as a source of computer anxiety is interesting as revealed in this study, in that while boys exhibit less anxiety than that of girls (Graff, Davies and McNorton, 2004; Abler and Sedlacek (n.d.) again the reason behind the differences is hard to pin down. Both of these studies speculate that boys may be less anxious because of the familiarity issue again, namely that boys like to play computer games more than girls (Comber, et al, 1997). The problem with this type of analysis is that it is difficult to determine cause and effect. Do boys play computer games because they are less anxious about computers? Or are they less anxious because they play computer games, giving them more familiarity. Comber, et al. (1997) argues that girls don't see playing computer games as a feminine activity, therefore reducing their exposure to the games and computers in general.

Instructional Method as a source of computer anxiety also proves to be difficult to analyze in any definitive manner in that the teaching methods used by the various practitioners presented in this study all reportedly proved to help alleviate anxiety among students. This is explored further in the

presentation of the four pre-selected case examples profiles, in the Analysis

of Data chapter.

General Thoughts Relating to the Sources of Computer Anxiety

The research indicates that while things such as gender, age, instructional method and general psychological factors have an influence on determining the source of computer anxiety, each of these factors points to previous computer exposure as the root beneath the anxiety. For example, age in an of itself may not be the real source of computer anxiety; it simply looks that way because older adults have not had the exposure that younger people have. The same may be said for gender, i.e., males are not necessarily less prone to computer anxiety simply because they are male, but rather they are less prone because they have had more experience. Certainly the data is inconclusive.

Discussion of the Characteristics of Computer Anxiety

Of the five identified sources of computer anxiety, age proved to be the most broad in the number of terms used to describe the relevant characteristics of computer anxiety (nine), including computer anxiety, fear of computers (2), negative perception, distrust, resistance, hesitancy, unable, and the fear of breaking something. The range of terms used in describing computer anxiety indicates how much of a role that age plays concerning computer anxiety.

The initial set of search terms used in describing computer anxiety, (computer anxiety, computer phobia, technophobia, fear of computers, stress, apprehension, negative perception and negative attitude) yielded a number of additional terms (nine) that also related the characteristics of computer anxiety, including, distrust, less confidence, resistance, hesitancy, unable, unwilling, the fear of breaking something, avoidance, and uncertainty. This list is indicative of two things. First, computer anxiety is very real and prevalent throughout the computer-based educational environment. Second, the lexicon used in describing computer anxiety is quite broad and not standardized, making categorization of the terms difficult. Terms such as "hesitancy (Baldi, 1997) and "resistance (Joseph & Stone, 2005) are quite similar and may actually be used similarly by the authors, but it's not clear. Additionally, this study did not attempt to make such distinctions.

Discussion of the Case Examples

The four pre-selected case examples all used different pedagogical techniques in training their students, yet all were successful. This may be attributed to the fact that each case example had a very specific population with instructional goals specific to that population. This indicates that no "one" method is necessarily the "right" method when creating training designed to reduce computer anxiety as one goal of the training.

Further examination of the case examples yields another factor that may explain the success of the pedagogical methods used. When categorizing the pedagogical method into Kolb quadrants, each of the case examples incorporated techniques that could be classified in each of the four categories. In other words, all of the four quadrants were represented in each of the successful case examples, indicating that Kolb's theory of learning seems to be a very appropriate framework when it is applied to the design of computer training. Even though the pedagogical techniques are specific, certain common techniques surfaced when reviewing the references and case examples:

Campbell and Wabb (2003) offer:

- Repetition. Doing the given task over and over again as a way to re-enforce the skill.

- Constructivist Learning. Teach students by fitting new information together with what they already know.

Baldi (1997) and Dutke & Reimer (2000) offer:

- Discovery Method. The approach to computer learning where the participant is allowed to play and discover how things work by trying them out.

- Play/Work Approach. Presenting the material as "we have this work for you to do" versus "We have a game for you to play"

- Paced/Un-paced learning. An approach where the sections/chapters/units are self-paced or are presented on a timetable.

- o Visual Analog Model. The material is presented in a visual manner as opposed to textual.

- o CD/Book presentation. This method explores how students perform after receiving instruction via CD ROM versus traditional printed material.

- o Segregated Environment. Also applicable to general psychological factors, this method segregates the users into like groups; age, or gender for example.

Possibilities for Future Research

Since previous exposure to computers appears to lower computer anxiety in all student populations, possible future research could be developed to determine ways of lowering physical and economic barriers, making access more universal. In addition, Kaczmarczyk (n.d.), Schweikart (2002) and Graff et al (2004) suggest that race and culture play a significant role in computer access. Further research focusing on this aspect could yield useful information in determining how to reduce cultural influence impacting computer access.

Multiple references address the influence of cognitive factors on computer learning (Graff, M., Davies, J. and McNorton, M. 2004; Atkinson, S. 2004; Price, L. 2004). A study of this single factor alone as a source of computer anxiety could yield a wealth of data about the potential relationship between cognitive factors and computer anxiety and how to overcome that anxiety.

APPENDIX A: Kolb Learning Cycle

Kolb Learning Cycle (as described by Harb and Terry).
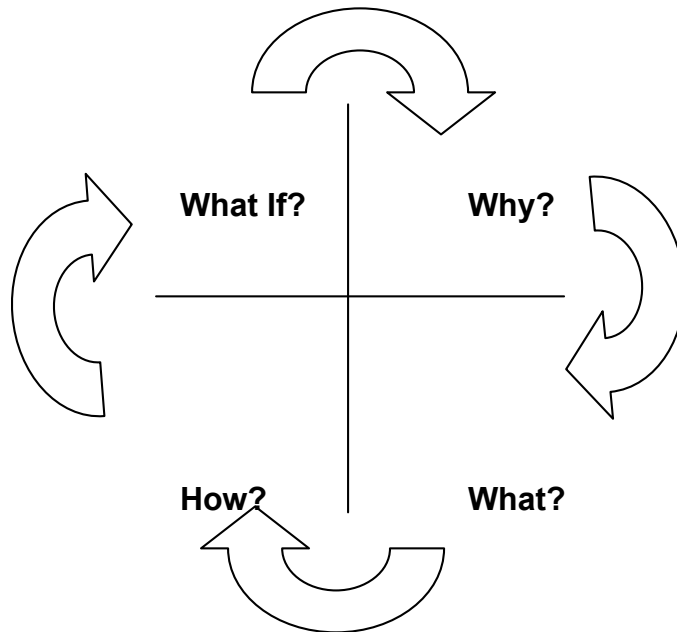
Originally based on the work by Lewin (1952) the Kolb Learning Cycle was described as **Concrete Experience** leading to **Reflection** leading to **Abstract Conceptualization** followed by **Active Experimentation,** which leads back to **Concrete Experience**" (Atherton, 2004). Harb and Terry simplify this process by defining the cycle as "Why" (Concrete Experience), "What" (Reflection), "How" (Abstract Conceptualization) and "What If" (Active Experimentation).

APPENDIX B: Harb & Terry's (1992) teaching methods, classified in the Kolb Learning Cycle

Kolb Quadrant #1 – Why? (The Concrete Experience)

- Motivational Stories
- Simulations
- Class Discussion
- Group Discussion
- Journal Writing
- Brainstorming
- Interactive Lecture
- Group problem Solving

- Formal Lecture, feeling tone
- Field Trips
- Role Playing
- Socratic Lecture
- Group Projects
- Group Experiments
- Subjective Tests

Kolb Quadrant #2 – What*? (Techniques for reflection)*

- Formal Lecture, thinking tone
- Lecture with Visual Aids
- Lecture with Programmed Notes
- Textbook Reading Assignment
- Problem Solving by Instructor
- Demonstrations by the Instructor

- Example Problems from Textbook
- Professional Meetings
- Large Seminars
- TV Demonstrations
- Independent Research
- Objective Exams
- Library Searches
- Gathering Data

Kolb Quadrant #3 – How? (The ways to promote abstract conceptualization)

- Example Problems Worked by Students
- Homework Problems
- Guided Labs
- Computer Simulations
- Field Trips

- Objective Exams
- Laboratory Test
- Individual Reports
- Computer-Aided Instruction
- Lectures with Demonstrations

Kolb Quadrant #4 – What If? (The techniques for active experimentation)

- Open-ended Problems
- Open-ended Laboratories
- Student Prepared Problems
- Field Trips
- Student Presentations
- Semester Long Design Projects
- Socratic Questioning
- Group Discussion
- Student Lectures
- Brainstorming
- Role Playing
- Subjective Exams
- Training

- Think Tanks
- Quality Circles
- Simulations
- Group Problem Solving
- Group Projects/Reports

APPENDIX C: Definitions

Computer Anxiety - The fear of impending interaction with a computer that is disproportionate to the actual threat presented by the computer. (Howard, Murphy & Thomas, 1986 as cited by Orr (n.d.)). Generally synonymous with the "Computer Anxious" (Smith and Kotrlik, n.d.; Orr, n.d.) and Technostress (Goldsborough, n.d.)

Computer-Aided Learning – The use of computers to facilitate learning in a classroom environment. Also known as CAL. (Atkinson, n.d.)

Computer-Based Training – Commercially available software designed to train users in the particular application. Also known as CBT. (Desai, 1999).

Computer Anxiety Index – "A instrument that provides a quantitative measure of computer anxiety level…". Also known as CAIN. (Hayek and Stephens (1989) as cited by Desai, 2001).

Computer Training – "This industry comprises establishments primarily engaged in conducting computer training (except computer repair), on topics such as computer programming, software packages, computerized business systems, computer electronics technology, computer operations, and local area network management. Instruction may be provided at the establishment's facilities or at an off-site location, including the client's own facilities." (www.ibisworld.com).

Constructivist Teaching – An approach to teaching that assumes that all learning is built (constructed) upon prior knowledge, beliefs and attitudes. (Learning Point Associates, n.d.)

Instructor based training - A combined traditional training, stand-up lecture and hands-on exploratory method. Also known as IBT (Desai, 1999).

Kolb Learning Cycle – A description of learning styles derived from the manner in which the individuals perceive and process information. Specifically (1) *why*, (2) *what*, (3) *how* and (4) *what if* as described by David Kolb, PhD. See APPENDIX A (Harb and Terry 1992).

Logizomechanophobia – Clinical definition of the fear of computers and is synonymous with computerphobia. Manifests itself as breathlessness, excessive sweating, nausea, dry mouth, feeling sick, shaking, heart palpitations, inability to speak or think clearly, a fear of dying, becoming mad or losing control, a sensation of detachment from reality or a full blown anxiety attack. (Phobia-Fear-Release.com)

Pedagogical methods - The methods and techniques used in teaching. For the purposes of this study, pedagogical methods are the methods described by Harb and Terry (1992) in a monograph discussion of teaching techniques as they apply to the Kolb Learning cycle (See APPENDIX A and APPENDIX B).

Performance Objective Domain – A description of a learning method that involves having students operate the computer as the instructor lectures. Also known as POD (Latimore, 1996)

APPENDIX D: Acronyms

CAIN – Computer Anxiety Index (Hayek & Stephens (1989) as cited by Desai, 2001).

CAL – Computer Aided Learning (Atkinson, n.d.)

CBT – Computer Based Training (Desai, 1999).

EUC – End User Computing (Desai and Richards, 1999).

IBT – Instructor Based Training (Desai, 1999).

POD - Performance Objective Domains (Latimore, 1996)

URL - Uniform Resource Locator. The web address of a particular website.

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