Relationship of Self-Efficacy to Stages of Concern in the Adoption of Innovation in Higher Education

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ABSTRACT

In this research, it was proposed that self-efficacy is the missing underlying psychological factor in innovation diffusion models of higher education. This is based upon research conducted in the fields of innovation-diffusion in higher education, technology adoption, self-efficacy, health and behavioral change. It was theorized that if self-efficacy is related to adoption, it could provide a quick-scoring method for adoption efficiency and effectiveness that would be easy to administer. The innovation-diffusion model used in this study was Hall and Hord's (1987) Concerns Based Adoption Model (CBAM) and it's Seven Stages of Concern (SoC) About an Innovation. The SoC measures a user's perception of—and concerns about—an innovation over time. The self-efficacies under study were general, teaching, and technology. The scales used in this research instrument were Chen's New General Self-Efficacy (NGSE), Prieto's College Teaching Self-Efficacy Scale (CTSES), and Lichty's Teaching with Technology Self-efficacy scale (MUTEBI), respectively. This research hoped to uncover a relationship between self-efficacies and a Stage of Concern in the adoption of an instructional technology innovation, Google Apps for Education, at a large university institution. Over 150 quantitative responses were collected from a pool of 1,713 instructional faculty between late Fall

2012 and early Spring 2013 semesters. The response group was not representative of the larger population. Forty-six percent represented non-tenure track faculty compared to the expected 19 percent. Analysis using nominal logistic regression between self-efficacy and Stages of Concern revealed that no statistically significant relationship was found. Of note is that nearly all participants could be classified as being in the early-stages of an innovation adoption, possibly skewing the overall results.

Dedication

Dedication is not what others expect of you, it is what you can give to others.

I dedicate this dissertation to:

My family and friends, because of all of their love and support.

All the naysayers, because success is the best revenge.

Acknowledgements

I want to thank my husband, partner, best friend, and confidant, Florin Mircea Marcu, Ph.D. I could write volumes about how wonderful and brilliant he is; how supportive and helpful he is; how hilariously rational and engineer-like he is. It would all be true. Yet, nothing is truer than his unconditional love and unwavering belief in my ability to accomplish and to succeed. When I had doubts, he never did. When I needed help, he readily offered assistance. And when some tough love was needed, he delivered it sparingly. I love and cherish him and have the utmost respect and gratitude for his contributions during the time it took me to start and finish the entire Ph.D. process. I sincerely doubt there is a better first mate than he.

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emotional support (and friendships) I ever needed as I navigated the academic experience. The VT Writing Center provided amazing one-on-one writing assistance and direction, making me proud to call this dissertation my own.

I also want to thank the myriad of friends and colleagues that provided support (and an ear) during my doctoral work. Thanks to the folks at Learning Technologies for the collegial work atmosphere. I'll forever remember the lunches, the intelligent conversations, and the laughter. Thanks go to my husband's engineering colleagues for your completely different perspectives into my own educational research. Thanks to members of the IDT cohort for reminding me that dedication and perseverance would pay off.

And lastly, I want to thank my ego. *I know it sounds odd and egotistical, but hear me out.* I'm not talking about ego, the megalomaniacal inflated self-worth that we so often criticize. I'm referring to the ego that is defined as that delicate, mediating, organized, realistic part of my psyche that balances the desires of the *id* and the *super-ego*. Without my ego, I would never have considered pursuing such a long-term accomplishment amidst adversity. Sometimes, I'm not sure how or where my ego found the ways to delay immediately gratifying pursuits—fooling me into thinking that years away from socializing would be fun—but I'm glad that it did. I appreciate this innate part of me; it has routinely and throughout life been stable and consistent, providing a rational yet fulfilling outlook on life, even when there were times I wished it away. *Thank you, little ego, for doing what you do so well. (Keep it up!)*

For everyone above and elsewhere in my life, I look forward to keeping in touch and continuing a lifelong intellectual partnership!

Table of Contents

Dedication iv

Acknowledgements v

List of Figures xii

List of Tables xiii

Chapter I: Introduction 1

Introduction to the Study 1

Innovation Models in Higher Education 2

The Cost of Adoption 3

Purpose vs. Need of the Models 4

Underlying Psychological Factors 4

Technology Acceptance Model (TAM) 5

Concerns Based Adoption Model (CBAM) 7

Other Innovation Diffusion Models 9

Problem Statement 11

Purpose of the Study 12

Research Questions 12

Innovation Identification 12

Identify Stages of Concern (SoC) 12

Self-Efficacy and SoC 12

Benefits of the Study 13

Organization of the Study 13

Definition of Terms 14

Chapter II: Review of Literature 18

Innovation and Diffusion Studies 18

Rogers' *Diffusion of Innovations* 18

The innovation. 19

Communication channels. 19

Time. 20

The social system. 20

Adopter categories. 21

Key Players of Change 22

Opinion leaders. 23

Change agents. 23

Change agency. 24

Change agent facilitation. 24

Innovation and Technology 26

Pedagogy and technology as one innovation. 27

Summary 28

Concerns Based Adoption Model (CBAM) for Higher Education 30

Stages of Concern (SoC) 32

Psychological factors. 36

CBAM SoC studies. 37

Summary 42

Change Models That Incorporate Self-Efficacy 44

Technology Acceptance Model (TAM) 49

Psychological factors and predictors. 50
Transtheoretical Behavioral Change Modification (TBCM) model 52
Development of the model. 53
Psychological factors and predictors. 53
Relationship of TBCM to Self-Efficacy. 54
Congruence of Models 57
Previous Research Analysis 61
Summary 63
Summary 65
Chapter III: Methodology 68
Purpose Statement 68
Research Questions 68
Innovation Identification 68
Identify Stages of Concern (SoC) 68
Self-Efficacy and SoC 68
Population Profile and Setting 69
Overview 70
Sex and Age 71
Degree, Rank, and College 71
Goodness of Fit 72
Teaching Experience and Class Size 73
Computer Skills and Preference 73
Instruments 73

Demographic Data 74
Prieto's College Teaching Self-Efficacy Scale (CTSES) (Prieto, 2005, as translated by Pajares, 2006) 75
Lichty's Teaching with Technology Self-Efficacy Scale (MUTEBI) (Lichty, 2000) 76
Chen's New General Self-Efficacy (NGSE) Scale (Chen, Gully, & Eden, 2001) 77
Stages of Concern (SoC) and Questionnaire (SoCQ) (George, Hall, & Stiegelbauer, 2006). 78
Overview of SOCQ. 78
Reliability/Validity. 78
Scoring. 79
Procedures 80
Overview 80
Data Analysis 82
Description of Self-Efficacy Scales Responses 83
Description of Stages of Concern Questionnaire (SoCQ) 84
Pilot Study 87
Chapter IV: Results 88
Overview of Data Collected 88
Research Question One Results 88
Research Question Two Results 91
Demographics 91
SoCQ Profiles 92
Individual Profiles. 94
Group Profile. 96

Research Question Three Results 97

Research Question Four Results 98

Research Question Five Results 99

Post-hoc Analysis 99

Chapter V: Discussion 101

Limitations 105

Considerations and Recommendations 109

References 112

Appendix A: IRB Approval 122

Appendix B: Participant Recruitment Materials 124

Appendix C: College Teaching Self-Efficacy and the Stages of Concern (SE-SoC) 129

Appendix D: Sample of Stages of Concern Individual Profiles 149

Appendix E: Stages of Concern Group Profile 154

Appendix F: A Breakdown of Summaries from Results of the SE-SoC Survey Instrument. 155

Appendix G: Results of Pilot Study 169

Preliminary Data Analysis 171

Overview. 171

Sex and Age. 172

Degree and Rank. 172

Goodness of Fit. 172

Appendix H: Permission to Use Watson's (2007) Survey Questions 174

Appendix I: Fair Use Analyses 175

List of Figures

Figure 1. Innovation diffusion models across different disciplines share roots with Rogers' (1962) original *Diffusion of Innovations* model..... 10

Figure 2. The S-shaped rate of adoption curve of an innovation (left) and the innovativeness dimension, as measured by the time at which an individual adopts an innovation (right), adapted from Rogers (2003, p. 113 & 181). [Fair Use] 22

Figure 3. The bell-shaped relative percent of adopters of an innovation with Moore's Chasm (Moore, 1999, 2002, 2004). Anything to the right of the Chasm, Gladwell (2002) refers to as "the tipping point," indicating an acceptance of the innovation by the audience. [Fair Use] 29

Figure 4. The Stages of Concern About an Innovation with Categories. (George, et al., 2006, p. 8). [Fair Use] 34

Figure 5. Innovation diffusion models from Business/IT, Health and Behavior Science, and Higher Education share roots with Rogers' (1962) original *Diffusion of Innovations* model. 58

Figure 6. Parallels between TBCM (Prochaska & DiClemente, 1982) and CBAM SoC Model (George, et al., 2006). 64

Figure 7. The Stages of Concern About an Innovation with Categories. (George, et al., 2006, p.8). [Fair Use] 86

Figure 8. The individual average scores of the Teaching with Technology Self-Efficacy scale (MUTEBI) plotted against the three categories of the Stages of Concern (SELF, TASK, and IMPACT). The overwhelming reports of Stage 0, 1, 2 (SELF) from the concerns profile may skew the overall result. 100

List of Tables

Table 1. Advantages of each Innovation Adoption Model. 63

Table 2. Faculty Rank Percentages at Sampled Institution (Fall 2012)..... 70

Table 3. Respondent Reported User-Type of Innovation (Google Applications). 89

Table 4. Respondent Reported Years Using the Innovation (Google Applications)..... 90

Table 5. Formal Training Which Respondents Attended. 91

Table 6. Respondent Reported Involvement in Another Innovation. 92

Table 7. Stages of Concern Response Summary as Categories..... 93

Table 8. Stages of Concern Response Summary (Cumulative, Normalized)..... 94

Table 9. p-Value of General Self-Efficacy on Stages of Concern. 98

Table 10. p-Value of College Teaching Self-Efficacy on Stages of Concern. 98

Table 11. p-Value of Teaching with Technology Self-Efficacy on Stages of Concern. 99

Table 12. Self-Efficacy Scales Responses Summary 104

Chapter I: Introduction

Introduction to the Study

"Battles are won primarily in the hearts of men … you've got to win the hearts of the people you lead" (Lombardi as quoted to Phillips, 2002, p. 60).

Change can be a surprise or seemingly inevitable. For any change that happens, the process can be measured, mapped, studied, and explained. In fact, "how change happens" has been extensively studied since Ryan and Gross' (1943) publication, "The diffusion of hybrid seed corn in two Iowa communities," was published in *Rural Sociology*. That instrumental work inspired generations of researchers across many disciplines to consider how ideas, communication, and change happens. In 1962, Everett Rogers published his original work, *Diffusion of Innovations* after reviewing a collection of similar diffusion studies from sociology, anthropology, and communication theory. Rogers' work provided a theoretical model to explain how innovations are shared and adopted, and how change comes about. From this, the realm of innovations, the study of diffusion, and the language of adoption was officially born.

An innovation can be defined as anything that presents the opportunity for change. It can be a new idea or a previous idea revisited. An innovation can be a process, procedure, product, or ideology. The study of innovations and how they are diffused among an audience is not limited to a particular discipline; it is a study of human nature and how individuals and groups react to and influence change.

One of the most adaptive and interested disciplines in diffusion studies is higher education. Higher education is ideal for diffusion of innovation research for two reasons: at the individual-level, research and faculty freedom is at the heart of fostering innovation and change;

at the college or department-level, pedagogical and technological change is ever-constant (Barone, 2003; Duderstadt, 2000; Watson, 2007). As Watson (2007) reported:

> Universities of the 21st century are seeking to remain relevant in a rapidly changing social and cultural landscape … they have the potential to affect change locally, through interactions with individual faculty, and globally, as those faculty then exercise new ideas, practices, and technologies. (p. 2)

In higher education, Academic Information Technology (IT) departments often support these changes through strategically planned initiatives and technology implementation. Examples of commonly planned technology innovations include new versions of software, switching to a new Learning Management System, adopting a new teaching or assessment paradigm such as ePortfolio, or upgrading the digital Student Information System or Research Administration services. Together, these provide faculty and researchers with support services, technology, and opportunities to embrace new teaching practices or initiatives.

Innovation Models in Higher Education

In 1963, Wayson noted that the most remarkable findings from diffusion studies is that they "explain more about the innovations studied than about the 'why' or 'how' diffusion takes place among schools" (p. 288). In 1968 at the National Conference on the Diffusion of Educational Ideas, Rogers and Jain (1968) stated that "relatively little emphasis has been placed upon diffusion within organizational structures" (p. i) and that higher education institutions were an excellent place to study not only the individuals, but also the social structure, organizational variables, and communication paths within.

Since then, diffusion studies in higher education have resulted in a number of new innovation diffusion models. Initial models were specifically formulated to address the unique

circumstances of an innovation in higher education; most of those models represent a systemic perspective and little else. This perspective is clearly evidenced in the models by Havelock (1971; 1995) and Ely (1990). These models provide fantastic descriptive accounts of implementing change within the organizational and social structure of higher education. However, for the people responsible for implementing an innovation, the lament became, "How can I ensure an innovation implementation goes well? What is common between all implementations and what consistently works?" Unfortunately, strictly descriptive models of innovation adoptions were not sufficient to answer these questions. Practitioners wanted more than just descriptions. They wanted the ability to *prescribe how to enact* effective change for solid financial and social reasons (Hall & Hord, 1987, 2001; Hord, et al, 2006).

The Cost of Adoption

For the past 30 years, efforts have been made to address and to answer those questions of "How can I ensure an innovation implementation goes well? What is common between all implementations and what consistently works?" Many studies pertaining to implementing IT and educational reforms have been conducted in efforts to understand the adoption of innovations in higher education (Hall & Hord, 1987, 2001; George, Hall, & Stiegelbauer, 2006; Venkatesh & Bala, 2008). This is because low-adoption and non-use of innovations in organizations and institutions increase costs and negatively affects productivity.

A difficult implementation of an innovation can become expensive with dire short-term and long-term organizational effects (Venkatesh & Bala, 2008). Large-scale innovation adoption often puts the organizations at risk for huge financial losses. Examples from the IT industry can be easily cited: "Hewlett-Packard's failure [to successfully implement an innovation] in 2004

had a financial impact of $160 million and Nike's failure in 2000 cost $100 million in sales" (Venkatesh & Bala, 2008, p. 274).

Purpose vs. Need of the Models

The purpose of most diffusion models is to describe what to expect. They are used by those implementing change to identify stakeholders, communication pathways, and potential problems. Once stakeholders are identified, communication plans drawn, and pitfalls are addressed, the hope is that the innovation will be successfully adopted by the majority of the intended audience in x time. While existing descriptive models are informative and helpful, the "holy grail" of an ideal adoption model would provide a *prescriptive* approach of adoption.

A *prescriptive* approach to an innovation adoption would accelerate and expedite the process with resounding success—meaning near-100% user-adoption in the least time required with limited resources—an unlikely reality, yet always the desired goal. It would allow organizations to allocate resources timely and appropriately, saving the institution money and time while also lessening adopters' emotional duress. To create a truly *prescriptive* approach to adoption, it would be necessary to understand the driving, underlying psychological factors of the innovation adopters themselves.

Underlying Psychological Factors

In recent years, research into granular, affective characteristics of adopters has begun to address the "why" and "how" of adoption. At present, the research is far from complete or comprehensive; many avenues for study have been suggested with only a few of those being examined. Models that combine: (a) a systemic view, with (b) attributes from Rogers' (1962) *Diffusion of Innovations*, with (c) research into affective characteristics to create a (d) prescriptive model for innovation adoption is desired. From this line of reasoning, only recent

diffusion models examining the affective characteristics of the adopters are ideal for study. As of the 2000s, only a few models attempted to combine these elements. One model, the Technology Acceptance Model (TAM) focuses on attempting "to predict individual adoption and use of ITs" (Venkatesh & Bala, 2008, p. 276). The TAM attempts this by identifying an adopter's *perceptions of the technology innovation* under study. The second model is Hall and Hord's (1987) Concerns Based Adoption Model (CBAM) which places an equal—if not greater—emphasis upon the measurement and importance of a *faculty member's concern* as they engage an innovation.

The TAM and CBAM are the best candidates for review since they both meet the majority of criteria for a desired prescriptive approach. Despite this similarity, each takes a different approach to the same problem, "What drives adopters to adopt, or not?" Only one, the CBAM, provides an ideal foundation upon which to pursue a course into responsible factors for adoption, but both will be explained below since the TAM is widely popular and deserves an explanation for its exclusion in this study.

Technology Acceptance Model (TAM)

Since the focus of the TAM is on IT adoption and IT continues to be a growing market industry, there is a plethora of IT adoption studies both in and outside of higher education. Many of these studies have suggested that investigating the adopter's *perceptions of the innovation* is the key to understanding and measuring success—where success can be defined by the rate at which the adoption occurs.

According to Venkatesh and Bala (2008), "researchers have provided new directions in individual-level IT adoption research with a particular focus on interventions that can potentially lead to greater acceptance and effective utilization" (p. 276). This means that the methods to

determine the user's comfort with IT are more specific than before. It also means that an innovation may be altered to give adopters easier access to successful adoption. With the TAM, it is now possible to determine what level of comfort an adopter has with the innovation, as well as what adjustments to the innovation can be performed to improve adoption rates. The information gathered from these studies has been informative and widely used in creating user interface designs that are perceptively easier to use and impart a perceived advantage through use, both strong elements of successful adoption by a user.

Unfortunately, when measured as an element for explaining how, why, or when an adopter will adopt an innovation, the TAM still falls short. Although it can measure some amount of "technology trepidation" an adopter may experience, it is not a true gauge of their potential for innovation adoption. In recent literature by Venkatesh and Bala (2008), the TAM can only explain "about 40% of the variance in individuals' intention to use an IT and actual usage" (p. 276). In truth, the determinants *responsible* for users' adoption are still *unknown*.

Also, the TAM has been harshly criticized for its noticeable "lack of actionable guidance to practitioners" (Venkatesh & Bala, 2008, p. 274). While it provides insightful overviews of technology adoption and how to improve software design for favorable adoption, it has done little to explain the role of the adopter in terms of affective characteristics. This lends itself to being classified still as more of a descriptive rather than a prescriptive adoption model. Clear steps or precise explanations for when to provide certain types of solutions are also not provided in the TAM. This makes it difficult to put the theory of the model into practice. Lastly, the TAM still focuses more on the (technology) innovation itself rather than on the adopters of the innovation. Venkatesh and Bala (2008) themselves admit that the model and resulting processes are still *descriptive* and innovation-focused, not yet prescriptive and user predictive as hoped.

If the TAM, one of the mostly widely used technology adoption models in the world, does not necessarily hold the key to understanding what drives adopters to successful innovation adoption, then what other factors can be considered? Other researchers, including Hall and Hord (1987, 2001) and Watson (2007), have suggested that efforts to identify possible predictors of adopter success lie in "psychological factors … to explore how self-efficacy and motivation influence adoption" (Watson, 2007, p. 44). Self-efficacy is defined by Bandura, Zimmerman, Pajares, and others as intrinsic "beliefs about one's perceived capability … to attain designated types of performances and achieve specific results" (Pajares, 1996, p. 546). Motivation is defined as consisting of two parts: intrinsic and extrinsic motivation. Deci, Vallerand, Pelletier, and Ryan (1991) define intrinsically motivated behaviors as being "engaged in for their own sake—for the pleasure and satisfaction derived from their performance," (p. 328) whereas extrinsically motivated behaviors are "believed to be instrumental to some separable consequence," (p. 328) typically accomplished through external rewards.

Although motivation could be an avenue for study, Watson (2007) postulates that since "diffusion literature speaks indirectly to self-efficacy" and shares a number of parallels to change models from the behavioral change discipline, "this suggests that similar research models within diffusion studies could be informative and may result in the recommendation that change agents employ strategies that have the greatest, most positive impact upon adopter self-efficacy" (p. 44).

Concerns Based Adoption Model (CBAM)

In reviewing the CBAM, we learn that it is built upon the concept that "change begins with the individual, usually the teacher or adopter" (George, Hall, & Stiegelbauer, 2006, p. 1). The CBAM, focusing upon the adopter regardless of the innovation under study, is in stark contrast to the approach of the TAM. Results from a CBAM study produce insights both into

how the adopters *perceive the adoption* and how they are *feeling about the innovation*. It is in the revelation of how an adopter expresses and manifests their concerns about an innovation that is thought to be the first peek into the depths of what helps or hinders an adopters' experience.

Originally developed in 1973 by the Research and Development Center for Teacher Education at the University of Texas at Austin, the CBAM reveals "what happens when individuals are asked to change their practice or adopt an innovation" (George, et al., 2006, p. 1). Since the 1970's, CBAM has been gaining popularity in educational settings (George, et al., 2006, p. 1). In 1987, with Hall and Hord's publication, "Change in Schools: Facilitating the Process," CBAM began to flourish and enjoy widespread use. There are several reasons for why it is successful; the model provides four different methods to understand change, includes methods for measuring change, and ultimately provides prescriptive instructions for facilitating change in education. Indeed, it is the model closest to the desired prescriptive approach, but even according to the proponents of the model (Hall & Hord, 1986, 2001), it still does not capture the true "underlying psychological factors that influence innovation adoption" (Watson, 2007, 43).

What the CBAM does capture is *how an adopter feels about an innovation* and the *adopter's concerns about an innovation*. These two things have already proven helpful to those facilitating change, often referred to as change agents. This knowledge allows the change agent to select "strategies that attempt to decrease clients' fear of an innovation, mitigate clients' insecurity about their ability to use an innovation, and bolster client confidence regarding future success with the innovation" (Watson, 2007, p. 44). Indeed, interventions and strategies for helping adopters through various stages can then be selected for use by change agents responsible for facilitating the change. As Watson (2007) points out in his research, "diffusion

literature speaks indirectly to self-efficacy" because of this role that change agent strategies play; Watson even directly likens it to Bandura's "four principal sources of self-efficacy" (p. 44).

The adopter-focused elements of the CBAM combined with an emphasis on alleviating the adopter's concerns makes the CBAM the ideal model for exploring the deeper affective characteristics at play. It is also suggested that the CBAM may help reveal the adopter's underlying psychological factors as to how, why, and when an adopter may adopt an innovation if parallels can be drawn between it and "research into overt behavior change" (Watson, 2007, p. 44). Based on his research into self-efficacy and innovation diffusion stages, he reported that "these contexts mirrors Rogers' innovation-decision process. This suggests that similar research models within diffusion studies could be informative" (Watson, 2007, p. 44). Indeed, if parallels between the CBAM and research in the behavioral change fields can be drawn, then it may become possible to answer the current laments of change agents, "How do I know what to do to facilitate the process with the adopting audience? How can we implement the innovation efficiently and effectively as possible? *What drives our audience to adopt or not?*"

Other Innovation Diffusion Models

Other fields and disciplines, such as health and behavior, also use innovation-diffusion models to describe and to explain adopter change. Consider Prochaska's (1979; Prochaska & DiClemente, 1982; Prochaska & Velicer, 1997) Transtheoretical Behavioral Change Modification model (TBCM). Unlike the TAM and CBAM, the TBCM does imply that psychological motivational components such as self-efficacy are key to behavioral changes through the stages of successful adoption. The TBCM model has served as the framework for multiple studies in health and exercise in conjunction with self-efficacy response scales since the early 1980s. Using ANOVA for analysis, researchers from these behavioral health disciplines

have since identified an adopter's self-efficacy in conjunction with their corresponding stage of change (or adoption) (Prochaska, 1979; Prochaska & DiClemente, 1982). Within the health and behavior discipline, it is suggested that self-efficacy may be the single most effective predictor of behavioral outcomes when adopting new habits. All of these models, the TBCM, TAM, and CBAM, share strong roots with the original *Diffusion of Innovations* model (Rogers, 2003) (see Figure 1). Because of the similarities among them, elements studied in one discipline might prove beneficial to study in another.

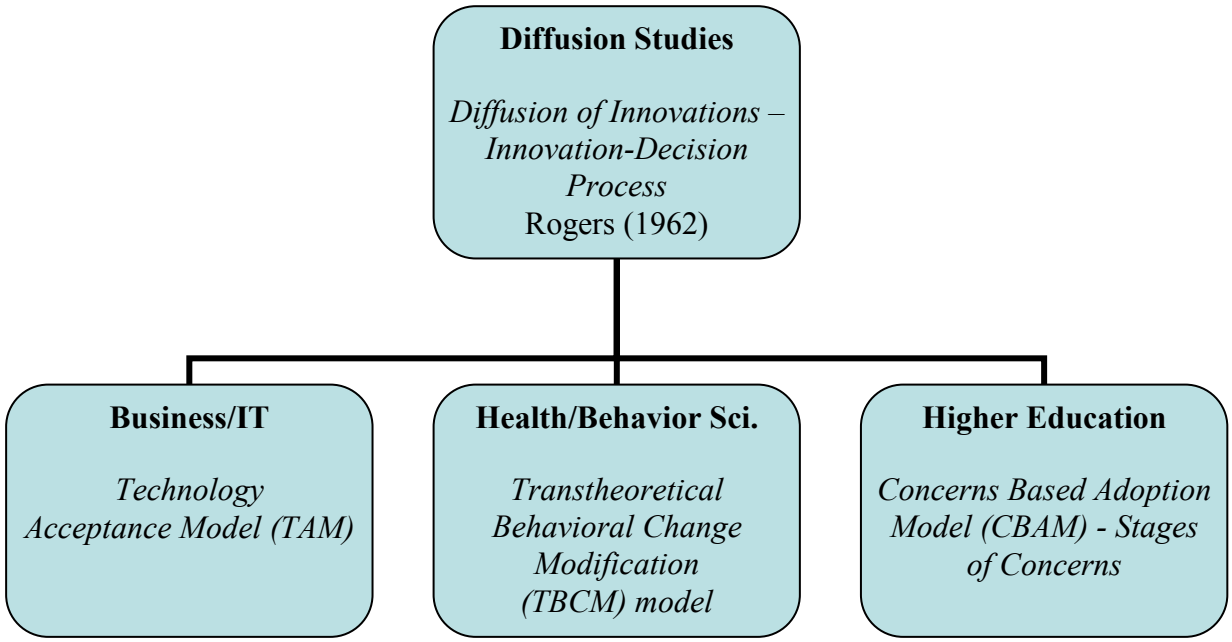

Figure 1. Innovation diffusion models across different disciplines share roots with Rogers' (1962) original *Diffusion of Innovations* model.

Research using the TBCM in health behavioral theory (DiClemente, Prochaska, and Gibertini, 1985; Marcus & Owen, 1992; Sniehotta, Scholz, & Schwarzer, 2005) and in psychology (Bandura, 1977, 1982; Bandura & Schunk, 1981; Ryan & Deci, 2000a, 2000b), has shown that intrinsic motivation and perceived self-efficacy contribute greatly to completing performance-based tasks successfully. Researchers in a variety of disciplines ranging from

psychology, health and behavioral science, education, and faculty development all agree that self-efficacy may be a primary mechanism to predict or accelerate behavioral change (Armstrong, et al., 1993; Bandura, 1977; Bandura & Schunk, 1981; DiClemente, et al., 1985; Galavotti, Cabral, Lansky, Grimley, Riley, & Prochaska, 1995; Pajares, 1996; Prochaska & DiClemente, 1982; Sniehotta, et al., 2005; Watson, 2007; Zimmerman, Bandura, & Martinez-Ponz, 1992). Therefore, could the CBAM serve as a parallel model to Rogers' and to the TBCM in studies of self-efficacy as the primary underlying psychological factors under study?

Problem Statement

[T]he factor most predictive of success in faculty motivation and development is depth of knowledge about the faculty members themselves and their personal characteristics. (Sloan, 1989, p. 134)

In this research, it was proposed that self-efficacy is the missing underlying psychological factor in innovation diffusion models of higher education. In Watson's (2007) research, he identified three self-efficacies for study: general, teaching, and teaching with technology; he looked for relationships between these self-efficacies and Rogers' (2003) innovation-decision process. For this study, these three self-efficacies were examined for relationships to the Stages of Concern in Hall and Hord's (1987) CBAM. Based on similar studies from parallel models of TBCM and other self-efficacy studies, it was theorized that if self-efficacy is related to adoption, it could provide a quick-scoring method for adoption efficiency and effectiveness that would be easy to administer. This information could improve the innovation roll-out at various levels. In an ideal world, the ability to easily measure, predict, and expedite a user's readiness to change (indicating his/her willingness to adopt) could be an incredible cost-saving solution for higher education and IT. Not only that, but research in this

area would provide insight to innovation diffusion studies in higher education that has been suggested, but not yet fulfilled (Venkatesh & Bala 2008; Hall & Hord, 1987, 2001; Watson, 2007).

Purpose of the Study

Through a quantitative study, this research explored the relationship between various self-efficacies and different stages of concern resulting from the pedagogical and technological adoption of an innovation, Google Applications for Education, in a higher education institution. The findings are based upon user's self-reports on self-efficacy response scales, and the completion of the CBAM Stages of Concern Questionnaire (SoCQ). The three self-efficacies under study were general, college teaching, and teaching with technology. The purpose for using a quantitative study was to allow for statistical analysis that could reveal exactly what kind of relationships, if any, existed.

Research Questions

This study was guided by the following research questions:

Innovation Identification

1. Which stage of Rogers' (2003) *Diffusion of Innovations* curve is the chosen innovation in?

Identify Stages of Concern (SoC)

2. What is the Stages of Concern profile for instructors in the use of the innovation?

Self-Efficacy and SoC

3. What is the relationship between instructor general self-efficacy and the categories of the Stages of Concern (SoC)?

4. What is the relationship between instructor teaching self-efficacy and the categories of the Stages of Concern (SoC)?
5. What is the relationship between instructor technology self-efficacy and the categories of the Stages of Concern (SoC)?

Benefits of the Study

The benefits of this investigation are three-fold: a) to contribute results to an area of innovation diffusion in higher education that has not yet been fulfilled; b) to determine if results from this study are consistent with those found in a sister innovation diffusion discipline, behavioral change; and c) to possibly suggest which (if any) self-efficacy may be a predictor of adoption categories (and ultimately successful adoption of an innovation) which should be further studied.

Organization of the Study

Chapter 1 provides the background information of the study, the statement of the problem, the purpose statement, the four research questions, the proposed benefits of the study, and how the study is organized.

Chapter 2 provides a review of the literature encompassing the topic of this quantitative research study. This chapter has five main sections. The first section details the history of diffusion studies from inception to present-day. It also explains the role that change agents have in the facilitation of pushing an adoption toward full acceptance. The second section provides an overview of innovation in higher education. During this section an in-depth examination of the higher education innovation diffusion model, CBAM, and specifically the Seven Stages of Concern About an Innovation (SoC) component and questionnaire (SoCQ) measurement is presented. The third section focuses on self-efficacy. In the fourth section, disciplines outside of

higher education that incorporate self-efficacy are reviewed and parallels are drawn between all innovation diffusion models regarding possible predictors of adoption success. The fifth section draws parallels between the different models and discusses the ability to share research paths between them. The sixth section discusses previous research and data analysis and why this research deviates by using nominal logistical regressions. The seventh section presents a summary of innovation, technology, self-efficacy, and the stages of concern altogether and concludes by presenting the need for the study.

Chapter 3 provides information on the methodological approaches that were used in this research study. The purpose statement and research questions for the proposed study are revisited, followed by information about the study participants, instruments used, data collection, and data analysis.

Chapter 4 provides the results of the statistical analysis. The chapter is organized according to the research questions.

Chapter 5 provides a discussion of the research study findings, limitations, and recommendations.

Definition of Terms

- **Change agent/agency**: an individual who exists to "influence clients' innovation-decisions in a direction deemed desirable" (Rogers, 2003, p. 27) by a change agency. A change agency is a body of people (ideally internal to an institution or organization) who see the adoption of the innovation as advantageous and positive in some way.
- **Concerns Based Adoption Model (CBAM)**: an innovation-diffusion model developed by the Research and Development Center for Teacher Education at the University of Texas at Austin to study "what happens when individuals are asked to change their

practice or adopt an innovation" (George, et al., 2006, p. 1). It is used extensively in K-12 and higher education institutions as a framework for change while also measuring, tracking, and recording change as a result of implementing an innovation. Its roots of origin stem from Rogers' (1967, 2003) *Diffusion of Innovations*.

- **Innovation**: nearly anything that presents the opportunity of change. It can be a new idea or an old idea revisited. It can be a process, a procedure, or an ideology. Innovations usually present a new or different way of doing something; an innovation may provide a method for obtaining some perceivable benefit or gain for an individual or group.
- **Innovation-diffusion**: the process of an idea from presentation to adoption is considered the realm of innovation-diffusion studies. Innovation-diffusion studies and models date back to Ryan and Gross and their diffusion paradigm in 1943, although Rogers' (1962, 2003) *Diffusion of Innovations* formalized many of their procedures and became the seminal work in the field (Greenhalgh, 2004; Robertson, 1967; Watson, 2007). All innovation-diffusion models indicate that change does not happen without communication, social networks, people, and personal interest. All innovation-diffusion models provide an explanation for the adoption of an innovation.
- **Self-efficacy**: "perceived self-efficacy is defined as people's judgments of their capabilities to organize and execute courses of action required to attain designed types of performances" (Bandura, 1986a, p. 391). Studies of self-efficacy since 1977 have confirmed that "perceived self-efficacy is a significant determinant of performance that operates partially independent of underlying skills" (Bandura, 1986b, p. 391).
- **Stages of Concern (SoC)**: is the shorthand reference to the Seven Stages of Concern About an Innovation. It is one of three components of Hall and Hord's (1987) Concerns

Based Adoption Model (CBAM). "An individual will perceive certain aspects of the innovation as more important than others at a given time" (George, et al., 2006, p. 7). There are seven stages in the model: 0-unconcerned, 1-informational, 2-personal, 3-management, 4-consequence, 5-collaboration, and 6-refocusing. From these seven stages, three groupings create the following categories: Self (0-2) Task (3), and Impact (4-6). Adopters of an innovation progress from little to no concern, to personal or self-concerns, to concerns about the task of adopting the innovation, to concerns about the impact of the innovation" (George, et al., 2006, p. 8). Its roots of origin stem from Rogers' (1967, 2003) *Diffusion of Innovations*.

- **Stages of Concern Questionnaire (SoCQ)**: was "developed to provide a quick--scoring measure of the Seven Stages of Concern About an Innovation" (George, et al., 2006, p. 11). The SoCQ is a 35-item questionnaire designed to collect an adopter's concerns about an innovation. From the data, a stage of concerns profile can be created. That profile illustrates what it is that the adopter is concerned about and what level of information or support they may require to successfully navigate to the next stage.
- **Technology Acceptance Model (TAM)**: is the model widely used in information technology innovations. "TAM was developed to predict individual adoption and use of new ITs. It posits that individuals' behavioral intention to use an IT is determined by two beliefs: *perceived usefulness*, defined as the extent to which a person believes that using an IT will enhance his or her job performance and *perceived ease of use*, defined as the degree to which a person believes that using an IT will be free of effort" (Venkatesh & Bala, 2008, p. 275). It's roots of origin also stem from Rogers' (1967, 2003) *Diffusion of Innovations*.

- **Transtheoretical Behavioral Change Modification model (TBCM)**: is an innovation-diffusion model used in health and behavior modification disciplines to explain adoption of new habits such as smoking cessation, contraception use, and exercise regimens. Sometimes, it is referred to as "the change of stages model." Prochaska is credited with its inception in 1979 and at that time the model consisted of four general stages. In 1982, Prochaska and DiClemente revised the model. To date, the model consists of several stages: pre-contemplation, contemplation, preparation, action, maintenance/relapse, and termination. (The last stage is often excluded due to the impossibility of zero temptation and 100% self-efficacy.) This innovation-diffusion model is unique as it specifically includes key concepts and notions regarding human behavior (i.e., self-efficacy and intrinsic motivation) in an explanation as to why and how behaviors change. Its roots of origin share those from Rogers' (1967, 2003) *Diffusion of Innovations* and from those in health and behavioral sciences.

Chapter II: Review of Literature

Innovation and Diffusion Studies

> "An innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption … If an idea seems new to the individual, it is an innovation" (Rogers, 2003, p. 12).

Diffusion studies developed from the fields of agriculture, sociology, and anthropology. They have since been translated to many other fields and disciplines (Watson, 2007). Rogers and Jain (1968) compiled extensive collections of agricultural patterns and paradigms of innovations from the 1930's and 1940's. The oft-cited, foundational work from this time was that of Ryan (1948) and Ryan and Gross (1943). The Ryan and Gross studies focused on the diffusion of hybrid-seed corn used by Iowa farmers. An uncharted territory at the time, Ryan and Gross studied how a new type of corn seed gained acceptance and eventual popularity amongst farmers--a notoriously resistant-to-change group. From this study, Ryan and Gross developed a methodology, theoretical framework, and interpretations that influenced their own discipline as well as other research traditions (Rogers, 2003). From this early work, diffusion-innovation studies were born. Shortly after, Everett Rogers formalized the process and procedures used by Ryan and Gross. From his work he wrote, *Diffusion of Innovations,* leading it to become the seminal work in the field of innovation-diffusion studies.

Rogers' *Diffusion of Innovations*

On the topic of innovation as change, no one is more highly regarded than Everett Rogers. Published in 1962, Everett Rogers' *Diffusion of Innovations* provided a conceptual and theoretical framework that continues to influence diffusion studies today (Gladwell, 2002; Watson, 2007). Rogers' work continues to remain relevant as can be seen in both research fields

and popular literature (i.e., in Gladwell's 2002 book, *The Tipping Point*). Many innovation-diffusion models in other fields attribute their work directly to the foundation of Rogers' theory. The theory provides an understanding of what diffusion of innovations is, how innovations are shared and adopted, how those changes come about, and who comprise the innovation-adopter categories.

Diffusion is defined by Rogers (2003) as "the process in which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). It is also a kind of "social change, defined as the process by which alteration occurs in the structure and function of a social system" (Rogers, 2003, p. 6). There are four elements in the diffusion of innovations. They are, "the innovation, communication channels, time, and the social system" (Rogers, 2003, p. 11). After that, a closer look into the people experiencing an adoption can reveal much about the individuals and the interactions among them.

The innovation. For Rogers (2003), innovation is "the idea, practice, or object that is perceived as new by an individual or other unit of adoption" (p. 12). Although many innovations may actually be new ideas or products, it is important to understand that "innovation suggests change" (Watson, 2007, p. 8).

Communication channels. Communication involves persuasion and the receptiveness to adoption stemming in part from exchanges through "channels." For a diffusion of innovation to be effective, the process requires the following components: the innovation, an experienced individual (or unit) innovation adopter, an uninformed individual (or unit), and some kind of communication channel between them. Channels can include one-way mass distribution (e.g., television, radio, newspaper, or Internet), or can be interpersonal (i.e., face-to-face exchanges, letters, email, chat) (Robertson, 1967; Rogers, 2003). Interpersonal communication is the

strongest and most effective method to persuade someone. The most important thing to recognize is that people depend "upon a subjective evaluation of an innovation that is conveyed to them from other individuals like themselves who have already adopted the innovation" (Rogers, 2003, p. 18). It is important to acknowledge that particular leader types with a high number of interpersonal channels are typically opinion leaders—recruiting others and leading them to innovation. His or her opinion can sway a group's opinion regarding whether or not to adopt the innovation or to choose some other innovation instead.

Time. An individual or group can provide the "seed idea" for an innovation and then that seed needs time to "germinate." Time pertains to how long the innovation-decision process takes. There are five steps in the time process: knowledge, persuasion, decision, implementation, and confirmation. In many ways, time is the crucial stage for an innovation's adoption. It is in this stage that an individual or group seeks information and processes how and why an innovation works (or does not work). As Robertson (1967) mentioned, close to 100% of individuals within a group or organization will eventually accept and incorporate an innovation if the innovation provides perceived advantages, "are decidedly better than existing forms," or can be "proved superior by objective measures" (p. 17).

The social system. Rogers' (2003) fourth and final element for diffusion of innovations is the social system. Rogers drew upon material that Katz, Levin, and Hamilton (1963) wrote about. Coming from a sociological perspective, Rogers and Katz, et al. address the importance of identifying the units (sub-group) of a social system, the opinion leaders, and change agents within. For example, doctors "tend to operate in informal, horizontal networks, and nurses more often have formal, vertical networks" (Greenhalgh, Robert, MacFarlane, Bate & Kyriakidou, 2004, p. 601). The social structures for each of these groups define how the information will

flow within and between the individuals. Because of this, the opinion leader and the change agent play important roles in this social element and will be discussed in detail later in this document.

Adopter categories. In general, Rogers (2003) derives a series of propositions about each type of user in the model. There are five types of Adopter Categories, a classification of members in a social system at the time the innovation is adopted. The five adopter categories are: innovators, early adopters, early majority, late majority, and laggards. They fall along a distribution curve (see Figure 2). As Robertson (1967) mentioned, Rogers' distribution suggests that 100% of individuals within a group or organization will eventually accept and incorporate an innovation. While this is highly unlikely, the numbers may come very close depending upon the effectiveness and advantages of the innovation.

Each categorization reflects the traits and attributes of the users within. For example, Rogers (2003) notes that innovators are "active information seekers about new ideas" and "are able to cope with higher levels of uncertainty" (p. 22). Innovators are the smallest of the adopter category groups. They are cosmopolites, actively social and well-connected to mass-media channels of communication. Next in the adopter category groups are the Early Adopters. Early adopters are respected individuals in their local social circle. They have the highest degree of opinion leadership and the "embodiment of successful, discrete use of new ideas" (2003, p. 283).

The next group of adopters are the early majority users. This group is one of the two largest groups of all of the adopter categories. These users frequently interact with their peers, but are seldom regarded as opinion leaders. This group uses social networks and communication channels to share and exchange their experience with the innovation. The quote, "Be not the first by which the new is tried, nor the last to lay the old aside" adequately describes this group's

outlook (Rogers, 2003). One of the last adopter categories and the second largest of all the groups are the late majority users (see Figure 2). These are the skeptics. Late adopters "do not adopt until most others in their system have already done so" (2003, p. 284). They feel uncertainty and may have scarce resources upon which to draw. The last adopter category are the Laggards. Laggards are traditionalists and are the last to adopt an innovation. Many are isolated with no opinion leadership. They are suspicious and resistant to change and change agents. Precarious economic or very scarce resources forces these individuals "to be extremely cautious in adopting innovations" (2003, p. 285).

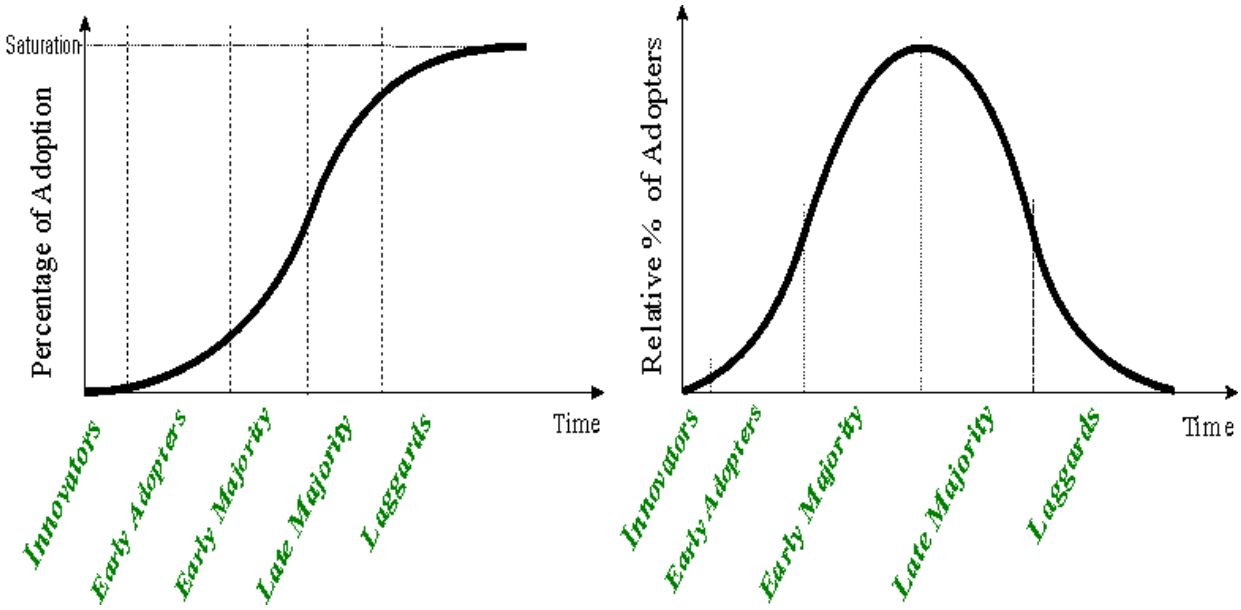

Figure 2. The S-shaped rate of adoption curve of an innovation (left) and the innovativeness dimension, as measured by the time at which an individual adopts an innovation (right), adapted from Rogers (2003, p. 113 & 181). [Fair Use]

Key Players of Change

Influential roles and types of adopters have been identified by Rogers in the overall social system. These "agents of change" are opinion leaders, change agents, and change agencies and

exist in all diffusion models. When considering recent literature, there is some discrepancy between the use of the words, *change agency*, *change agents*, and *agents of change* and how they function. Definitions of the terms and brief explanation of their roles will effectively clarify the importance of each in this review of the literature.

Opinion leaders. An opinion leader is someone who is not a leader through formal position or status, but is regarded as someone who is able to influence other individual's attitudes or overt behavior in an informal and frequent manner. Opinion leaders usually have a large and interconnected communication network, and are able to cross clique, unit, or organizational boundaries (Greenhalgh, et al., 2004; Rogers, 2003). Their most striking characteristic is their unique and influential position in their system's communication structure: they are at the center of interpersonal communication networks. They help spread ideas; however, because of their far-reaching capabilities, they run the risk of being discredited in some circles or as being deemed too deviant (rather than ground-breaking). Opinion leaders are often employed by change agents wishing to enact specific types of change.

Change agents. Change agents influence clients' innovation-decisions through the management of diffusion stages and by leveraging opinion leaders. Rogers (2003) defines a change agent as "an individual who influences clients' innovation-decisions in a direction deemed desirable by a change agency" (p. 27). This means that the change agent is the intermediary between the change agency group of adopters and the rest of the target population. The change agent is responsible for channeling information both ways, making social connections (with opinion leaders), and identifying impasse points. Change agents may also be (or additionally have) a change agent aide. A change agent aide is usually less involved in the actual adoption of the innovation or in their social ties to the change agency group, but offers

stronger compatibility and likeness to the target population. For both the change agent and aide, they are a bridge between groups, "a marginal figure with one foot in each of two worlds" (Rogers, 2003, p. 368).

Change agency. Change agency is a group (instead of an individual) that has identified the innovation to be adopted and is responsible for the larger adoption goals. Havelock and Zlotolow (1995), authors of *The Change Agent's Guide*, explain that a change agency is usually a group that has the primary purpose of facilitating an innovation within an identified organization. Built upon an organizational, systemic-model, the notion is that change agents (usually managers) can enact change at any level; however, these changes would produce "ripple effects" not necessarily felt throughout the system. Havelock and Zlotolow (1995) imply that change agencies in the 1980s and 1990s were most likely external (consultants) to the organization adopting the innovation and authorized by top-level executives, but change agencies could also be internal. Internal change agencies are considered to be more effective due to ownership over the diffusion of innovations process, knowledge of social norms, and existing relationships to adopters (Anderson, 1997; Watson, 2007).

To recap, opinion leaders help spread the innovation through their enthusiasm and social networks. A change agent is the individual between the group driving the change and the adopter audience, often working closely with the opinion leader. The change agency is the driving body of (ideally internal) people who see the adoption of the innovation as advantageous and positive in some way.

Change agent facilitation. How change agents enact the actual change is up for some debate. A review of the literature on change agent functions and change facilitation processes

provides insight. From that literature, an overview of what a change agent does is summarized below:

1. The change agent is to assess the user and to persuade the user to give the innovation a try.
2. The change agent works diligently to ensure an adopter has both the confidence and skills to succeed.
3. It is the change agent's responsibility to ensure successful adoption through appropriate interventions (addressing concerns, needs, resources, etc.).
4. Ultimately, the change agent must create a self-reliant user.

Rogers (2003) identifies seven functions that change agents should do. First, the change agent provides awareness of the innovation and helps the user self-recognize the need to change. Second, a relationship based on the exchange of knowledge, information, and trust is formed. Third, being empathetic to the user's problems and helping users come to solutions addresses needs before they block progress. Fourth, change agents motivate users to adopt the innovation. Fifth, users must take action to adopt the innovation. Sixth, change agents provide positive, reinforcing messages once the user has adopted the innovation. Lastly, the change agent must shift the relationship so that the user is self-reliant.

Hall and Hord (2001) propose a similar, but more structured multi-change agent perspective which follows similar principles. Because of their work in—and familiarity with—educational systems adopting innovations, they have come to understand that usually more than one change facilitator (their word for agent) will be necessary. "Our [original] study plan had naively assumed that most of the change-related interventions would be made by the principal" (Hall & Hord, 2001, p. 150). What they had discovered was that there was always at least one

other change agent--and as many as four. They found that additional change agents may be opinion leaders or early adopters and are often respected and well-regarded by their peers. Based on this knowledge, Hall and Hord (2001) constructed a method for multiple change agents to divide the tasks and strategies among them; key tasks were assigned to specific agents producing a list of what should be done.

Watson (2007) reviewed similar literature and found that it falls in line with what Hall and Hord (2001) identified as two important change facilitator strategies. First, it was identified that change agents' communication and interaction with clients is paramount. The message communicated to clients must change over time to align with the shift in client adoption. Second, ongoing and effective interaction with clients is necessary to remind the client to effectively interact with the innovation. Hall and Hord (2001; Hord, et al., 2006) would add that ongoing approvals and official recognition remind clients that successful use is possible. In conclusion, Watson (2007) found that the primary function of change agents wasn't the management of the innovation insofar as *the management of the people* targeted to use the innovation. The change agent has to win both the mind, hands, and heart of the user and according to Rogers (2003), the key component to understanding the success or failure of an innovation is to answer the questions that each *individual adopter* asks:

- "What is the innovation?"
- "How does it work?"
- "Why does it work?"
- "What are the innovation's consequences?"
- "What will its advantages and disadvantages be in *my* situation?"

Innovation and Technology

Many innovations are often technological and "technology" is sometimes used synonymously with "innovation." Rogers (2003) insists it is important to differentiate the two:

> A technology is a design for instrumental action ... involved in achieving a desired outcome. A technology usually has two components: (1) a hardware aspect, consisting of a tool that embodies the technology as a material or physical object, and (2) a software aspect, consisting of the information base for the tool. (p. 13)

Because technology is often a product (hardware or software) that supports another initiative or innovation, it can sometimes be difficult to understand if the "innovation" is the idea, the technology, or if they are one and the same. Moore, Fowler, and Watson (2007) explain the predicament higher education faces when adopting technology innovations aimed to improve pedagogy:

> For at least ten years, colleges and universities have attempted practical, though difficult, change interventions aimed at integrating technology into teaching and learning activities [...] Initiatives designed to closely associate appropriate technologies with content-specific information to achieve defining teaching and learning aims are largely creative, experimental endeavors. (p. 44)

When a pedagogical and technological innovation are so closely tied together, it is appropriate to consider them weaved together as one, but it must be clearly understood that "the innovation" then defines both the idea and the technology. While common, it creates an innovation more difficult to track and to successfully adopt.

Pedagogy and technology as one innovation. Ziegenfuss (2005) explains how instructional design strategies and methodologies actually effectively support the integration of technology into higher education. She explains how "the planning, organization, and

pedagogical issues associated with teaching and learning effectively become even more important when tools are introduced into the teaching and learning process" (p. 23). It becomes imperative then that the technology innovation is not being adopted for the sake of itself, but instead is provided as a way to enhance the desired instructional practice. As she sums it up, "pouring a solid foundation of good pedagogical design before adding on the layer of technology can become a critical factor in the success rate of technology integration" (Ziegenfuss, 2005, p. 23).

It is also worth noting that research by Fulk (1993), D'Silva and Reeder (2005), and Medlin (2001) illustrates that people using instructional technology innovations are influenced by the social groups they are part of. Shared, intra-departmental relationships and values "which include interpersonal relationships, decision processes, and common goals" (Medlin, 2001, p. 27) contribute to the successful use of the technologies in use. It is suggested that both of these aspects should be considered when implementing an innovation. To be successful, one must first provide a solid foundation of good pedagogical design, and secondly to combine it with a strong social support network (Medlin, 2001; Moore, Fowler, & Watson, 2007). That way, when the technology component comes to the forefront, the innovation may be more readily accepted and adopted.

Summary

An innovation can be defined as anything that presents the opportunity for change; it can be a new idea or an old idea revisited. An innovation can be a process, a procedure, a product, or an ideology. Innovations present a new or different way of doing something. An innovation may provide a method for perceptible benefit or gain. However, an innovation alone cannot enact change. Groups of people must communicate and exchange ideas between them. They

must share the innovation. Individuals must decide if they are interested in learning more about the innovation. Only then does an innovation have the opportunity to enact change. The innovation, communication channels, time, social systems, the adopters, and key players of change work together to create the diffusion of ideas, propagating ideas from one group to another.

The study of these communications is the diffusion of innovations. As groups of people communicate and the use of an innovation grows, change may be on the horizon. At this point, researchers and strategists talk about adoption. Adoption can be defined as whom and how many people have decided to "buy-in," use, or identify with the innovation and become part of the changing landscape. At some point, successful change jumps the chasm (Moore, 1999, 2002, 2004) and reaches what Malcolm Gladwell (2002) calls, "the tipping point" and becomes mainstream (see Figure 3). Less successful innovations flounder and remain limited to a subset of users. In some situations, an innovation may die out completely if it is never fully adopted.

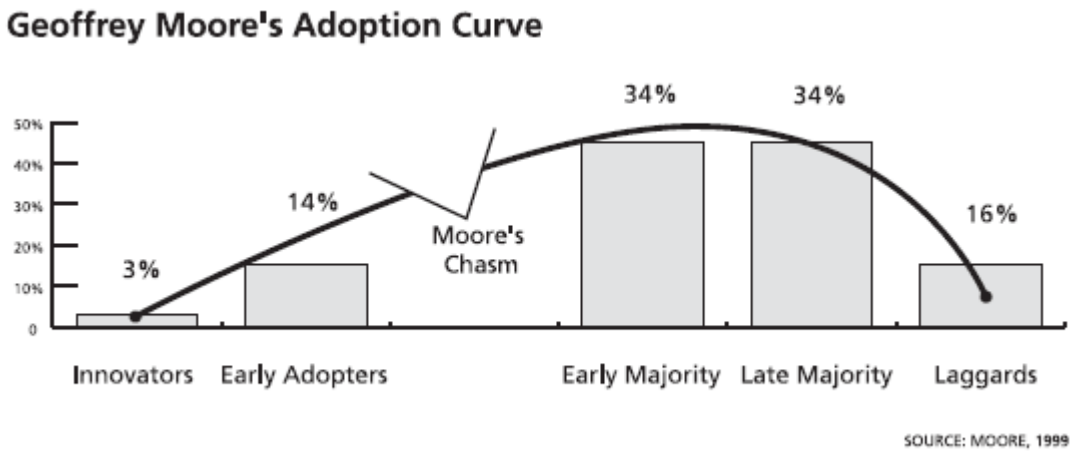

Figure 3. The bell-shaped relative percent of adopters of an innovation with Moore's Chasm (Moore, 1999, 2002, 2004). Anything to the right of the Chasm, Gladwell (2002) refers to as "the tipping point," indicating an acceptance of the innovation by the audience. [Fair Use]

Change agents can employ opinion leaders to lead an innovation and to help mainstream audiences adopt an innovation. This is done by the change agent leveraging the social system, opinion leaders, and the innovation itself. As long as the innovation stays within the norms of the intended audience and has a fairly good reason for adoption, persuasive interpersonal communication can further win adopters. The adopters share their news with their communication networks; if the innovation is positive (or mandated) eventually the majority of individuals will adopt it. Reinvention may occur, but generally adoption of the original innovation will become a norm for the individual adopters and for the larger intended audience unit. This happens largely due to time and through exposure to the social system using the innovation.

As far as innovations go, the introduction of technology as an innovation is common, especially in higher education when combined with an intended pedagogical innovation. When two ideas are weaved together as one innovation, it creates an innovation slightly more difficult to track and to successfully adopt. Change agents are recommended to take special care to first provide a solid foundation of good pedagogical design, and secondly to combine it with a strong social support network (Medlin, 2001; Moore, Fowler, & Watson, 2007) to facilitate adoption and to alleviate individual adopter concerns, especially in the context of higher education.

Concerns Based Adoption Model (CBAM) for Higher Education

Of the many innovation-diffusion models constructed for use in higher education, few enjoy widespread use like Hall and Hord's Concerns Based Adoption Model (Anderson, 1997; George, et al., 2006; Hall & Hord, 2001). There are two popular, widely respected features that may be the reason for this. One is the fact that the model demonstrates a comprehensive understanding of action research. "The concerns model was largely developed out of research to

support action, or the effective implementation of change. It is not a surprise that taking action would be one major outcome of the use of concerns data" (George, et al., 2006, p. 65). In fact, the CBAM provides four different methods to understand change, methods for measuring change, and outlines how to implement the intended change. Several action research books based upon CBAM have been published and the SEDL nonprofit institute conducts education research extensively around the use of CBAM in K-12 and higher education institutions. Second, the CBAM is one of the few models in higher education that considers the individual and the personal concerns as part of its evaluation of an innovation at the time of adoption.

"The Concerns Based Adoption Model, better known as CBAM, is arguably the most robust and empirically grounded theoretical model for the implementation of educational innovations to come out of educational change research in the 1970s and 1980s" (Anderson, 1997, p. 331). Foundations for the CBAM stem from a combination of pre-existing literature, Havelock's studies, and Havelock's Linkage Model (Watson, 2007). Originally created by Hall, Wallace, and Dossett (1973), the CBAM today is an adaptive systemic process, requiring change agents to first probe individuals and group levels to assess the current state of the system. It "describes, explains, and predicts probable behaviors throughout the change process" and provides change agencies and change agents a method to oversee and facilitate the process. The change agent continually adjusts interventions based on the collected information. Over 30 studies known by the authors have used CBAM in whole or part. Many of those were longitudinal studies which ran several iterations of the instruments at different stages of the innovation diffusion.

The complete CBAM consists of three parts: Stages of Concern (SoC), Levels of Use (LoU), and Innovation Configuration (IC) (Hall, et al., 1973):

1. Stages of Concern (Soc) are recorded through the Stages of Concern Questionnaire (SoCQ) and represent the "who" involved in the innovation adoption.
2. The Levels of Use assessment consists of one-legged interviews and branching interviewing techniques to reveal user behavior and how they are using the innovation.
3. The Innovation Configuration describes the innovation in action, revealing least desirable practices to exemplar implementations along a continuum.

For this research, only the SoC and the SoCQ will be used as this research is interested in gathering information about the personal and affective characteristics of users adopting a technology innovation.

Stages of Concern (SoC)

The Stages of Concern (SoC) about an innovation is one of three diagnostics of the CBAM and is concerned about the individual in the process of adoption. The SoC consists of seven stages of concerns: Stage 0 (Unconcerned), Stage 1 (Informational), Stage 2 (Personal), Stage 3 (Management), Stage 4 (Consequence), Stage 5 (Collaboration), and Stage 6 (Refocusing). The first three stages (Stage 0-2) make up a dimension of concerns about the "Self." The second dimension (Stage 3) consists of concerns regarding the "Task" management of the innovation. The third dimension (Stage 4-6) reveals concerns about the "Impact" of the innovation upon students or clients. (See Figure 4.)

In the dimension of *Self* concerns, Stage 0 (Unconcerned) embodies the characteristic that the participant is decidedly a nonuser of the innovation. They may or may not even be aware of the innovation's existence. Stage 1 (Informational) is where the individual is aware of the innovation and begins to seek general information about the innovation. Stage 2 (Personal) is when affective characteristics begin to come into play; an individual may be concerned about the

demands on their time and resources, their inadequacy to meet expectations, evaluating their place in the organization, and other conflicts and interpersonal issues that may arise.

IMPACT	6	Refocusing	The individual focuses on exploring ways to reap more universal benefits from the innovation, including the possibility of making major changes to it or replacing it with a more powerful alternative.
	5	Collaboration	The individual focuses on coordinating and cooperating with others regarding use of the innovation.
	4	Consequence	The individual focuses on the innovation's impact on students in his or her immediate sphere of influence. Considerations include the relevance of the innovation for students; the evaluation of student outcomes, including performance and competencies; and the changes needed to improve student outcomes.
TASK	3	Management	The individual focuses on the processes or task of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, and scheduling dominate.
SELF	2	Personal	The individual is uncertain about the demands of the innovation, his or her adequacy to meet those demands, and/or his or her role with the innovation. The individual is analyzing his or her relationship to the reward structure of the organization, determining his or her part in decision making, and considering potential conflicts with existing structures or personal commitment. Concerns also might involve the financial or status implications of the program for the individual and his or her colleagues.
	1	Informational	The individual indicates a general awareness of the innovation and interest in learning more details about it. The individual does not seem to be worried about himself or herself in relation to the innovation. Any interest is in impersonal, substantive aspects of the innovation, such as its general characteristics, effects, and requirements for use.
	0	Unconcerned	The individual indicates little concern about or involvement with the innovation.

Figure 4. The Stages of Concern About an Innovation with Categories. (George, et al., 2006, p. 8). [Fair Use]

For the dimension of *Task* concerns, Stage 3 (Management) is where the individual focuses on the processes and tasks to use the innovation, drawing on resources and information available. Innovation adopters at this stage weigh and deliberate how they will integrate the innovation into their existing and current obligations and practice.

For the dimension of *Impact* concerns, Stage 4 (Consequence) is where the individual considers the impact the innovation may have upon students, such as relevance, outcomes, performance, competencies, and skills that students may also need to improve their outcomes. Stage 5 (Collaboration) is when the individual seeks out and cooperates with others using the innovation. Stage 6 (Refocusing) is where the individual is trying to maximize the innovation's potential, seeking new ways to use it to garner additional benefits; in some cases, the user has begun to look past the innovation to see what changes or replacements are on the horizon.

CBAM literature indicates a change in a user's personal concerns as they move through the change process. Considering that the CBAM SoCQ records self-reported affective perceptions to change, the results reveal "reactions, feelings, perceptions, and attitudes" (Hall & Hord, 2001, p. 81) about an innovation. There are some assumptions made that one can "assume a one-to-one correspondence with movement" (Hall & Hord, 2001, p. 94) between the Stages of Concern and the how the users actually use the innovation, but it's only accurate at the outer levels; non-users (Stage 0) equate to having high personal concerns while avid users (Stage 4+) of an innovation are more concerned about the impact of the use.

In the CBAM literature, self-concerns are most prevalent at the onset of exposure to a new idea or innovation they are actually beginning to use (Hall & Hord, 2001; Rogers, 2003).

Their concerns change over time and with use of the tool, but this does not always happen in a progressive linear fashion (George, et al., 2006; Hall & Hord, 2001; Rogers, 2003; Venkatesh & Bala, 2008). It is possible for a person or group to have intense concerns in more than one stage. In fact, it is not uncommon for master teachers to have intense Stage 3 (Management) concerns while also having intense Stage 4 (Consequence) concerns, indicating both a need to successfully operate the innovation with consideration for how it affects her students. There are also times when the introduction of an innovation may not have been properly presented and supported. In those cases, the self-concerns are very high with little change either between stages or a "freezing" effect at Stage 3 (Management) regardless of how much time is spent using the innovation.

For any users in a given stage, attempting to provide material irrelevant to a user's stage of concern is ill-advised:

> Teachers with intense task concerns don't want to hear about the philosophy; they want help in making the innovation work more smoothly. The more abstract and subtle aspects of innovation use are of greater interest to teachers with impact concerns. (Hall & Hord, 2001, p. 61)

Therefore, it is paramount for change agents to only provide discussions and solutions that are relevant and required for the individual adopter at that moment. According to Hall and Hord, no other element may be as important as discovering what stage an individual adopter is experiencing concerns (CBAM), doubts, or "blockers" in their progress and how to alleviate those concerns.

The Stages of Concern Questionnaire (SoCQ) "provides a way for researchers, program evaluators, administers, and change facilitators to assess teacher concerns about strategies,

programs, or materials introduced into a school" (George, et al., 2006, p. xi). The SoCQ allows change agents to analyze the concerns individuals have at different stages of an innovation. The assumption is that in the early stages of innovation, participant concerns are very different than when they become familiar with the innovation. This can be used to estimate the level of change by analyzing the participants' concerns.

The SoCQ exposes the intended user's concerns, feelings, and perception of the innovation as it relates to him/her personally. Consisting of seven different stages, the early questions are self-oriented, the middle-stage questions are task-oriented, and the later stages are focused on impact and improvements. Part of this process is to collect observations and analyze the adopter's feelings, successes, failures, and overall progress when undergoing the change process. This information provides information about the readiness of the users and the potential pitfalls and successes to be expected. In turn, this information provides change agents and innovation facilitators the necessary information to provide positive interventions at critical moments or stages of the users' process to facilitate the successful adoption of the innovation and to help them progress to the next stage in the process. (Hall & Hord, 1987; Hord, et al., 2006) It should be clear that change is understood to be a developmental process, and that concerns held by an adopter should adjust or shift over time.

Psychological factors. The SoC does acknowledge that when users are adopting something new, users experience different types of concerns. Concerns are affective (emotional) and developmental, meaning that they change over time. To reiterate what was said previously about the Stages of Concern, the characteristics of technology adopters' concerns will fall into one of the three dimensions of the SoCQ:

1. Self – Users in this dimension want to know more about an innovation. They want to know if it is similar to what they are already doing.
2. Task – Users in this dimension need time to use the innovation. They need time to learn how to balance it with their existing duties and practices.
3. Impact – Users in this dimension are concerned about the influence of the technology upon their students or on the receiving-end of the adopted technology practice.

Of these, concerns can further be delineated into the seven stages: Stage 0 (Unconcerned), Stage 1 (Informational), Stage 2 (Personal). Stages 0-2 are considered to be the dimension of the "Self" and consist of self-concerns and non-users of the technology. Stage 3 (Management) is considered the dimension of the "Task" and embody concerns surrounding the use of the innovation by the user. Stage 4 (Consequence), Stage 5 (Collaboration), and Stage 6 (Refocusing) are in the dimension of "Impact."

As users deepen their understanding of the innovation and consider its effects on their students or clients, they ponder how to improve upon it or its effectiveness (George, et al., 2006; Hall & Hord, 2001).

CBAM SoC studies. George, Hall, and Stiegelbauer (2006) assert that technology is a common innovation for study when using the SoCQ: "many of the [CBAM SoC] studies have involved technology in one form or another … technology lends itself to use of the SoC or the SoCQ … simply because of its continuing 'newness'" (p. 64). Hall, George, and Rutherford (1986) explain the disruptive effect that a technology innovation has upon teachers:

> "When innovation is introduced into an organization, it affects the status quo. Teachers experience disequilibrium in anticipating and in beginning the transition from previous to

present. Teachers are engaged in a psychological tug-of-war …" (Hall, George, & Rutherford, 1986, p. 147)

Chamblee and Slough (2005) conducted a meta-analysis of 97 papers that used CBAM as the theoretical framework to assess technology-based change. A review of literature reveals 12 technology-innovation studies known to the creators of the SoCQ. These 12 studies consist of short-term and longitudinal research that dealt with technology innovations and used the SoCQ to gather concerns data on the adoption process. Two pertinent studies to this current research are included below. The first examines teachers' stages of concern when first adopting the use of a microcomputer, and the latter examines teacher concerns towards instructional technology.

Hope (1986) was among the first to conduct a thorough SoC study of 16 teachers in grades three through five during the introduction of microcomputer technology in a school. His study helped validate and illustrate that the SoCQ could be used to reliably measure the changes in concerns when implementing and adopting a technology innovation. He issued the SoCQ as a pre- and post-test. The pre-test SoCQ was conducted during the first semester of implementation in September 1993 and again as a post-test near the end of the second semester of the same year, in May 1994. Since the SoCQ was still fairly new and because he was using it as part of the larger Concerns Based Adoption Model, Hope also used multiple other sources of data for triangulation. This provided the necessary reliability and validity of the research findings. The sources of other data used were: direct observation, participant observation, interviews, archival records, and physical artifacts.

In Hope's study, teachers were to use a "teacher technology workstation" (a microcomputer, a printer, and two software programs). In order to provide the appropriate support, training, and interventions, Hope wished to capture "the intensity of teachers' concerns

about an innovation and the degree to which those concerns can be resolved" (Hall, et al., 1986, p. 151). Hope believed as Hall and Hord (1987; 1991) suggested, that concerns have a direct influence on whether or not the innovation adoption will be successful.

Hope used the "the simplest interpretation of the SoCQ" as suggested by Hall, George, and Rutherford (1986) and identified the highest stage score and the second-highest stage score for the group. Hope did this by tallying the number of individuals who had their peak scores in a particular stage and displaying that as a percentage of the teachers. For the first iteration of the SoCQ in September 1993, teacher self-concerns and nonuser patterns were prominent. The highest stage score for the group was 69%. These 11 out of 16 teachers had "high scores in the Awareness [Unconcerned], Informational, and Personal Stages of Concerns" (Hall, et al., 1986, p. 151). Four of those eleven were teachers in the Unconcerned stage (Stage 0), five were in the Informational stage (Stage 1), and two had high Personal concerns (Stage 2). The remaining five had Task concerns (Stage 3) and were concerned with managing the issues of time and preparation for inclusion into their existing practice. Of those five, four were pre-service teachers and already had familiarity with computers. These findings were confirmed by the other data collected (specifically, the researchers observing the non-use of the technology).

Hope (1986) understood that identifying the teachers' stages of concern was only the first step towards facilitating change:

> Identification of teachers' concerns about an innovation alerts the change facilitator to the kind of assistance teachers need. Using this information about the state of teachers' emotions regarding an innovation, a change facilitator can apply specific interventions to assists [sic] teachers in resolving their concerns. (p. 151)

This is in line with what George, Hall, and Stiegelbauer (2006), like Hall and Hord [1987; 1987] before them, reported—that concerns are influenced by the feelings of those involved with an innovation. Concerns include a user's perception of his or her ability to use the innovation and the environment in which the change occurs. Of most significance is the kind of support and assistance the user received during the change process.

Hope used two trainings as the primary method for addressing concerns and facilitating adoption. The first "training" was "informational" and consisted of demonstrations. This was consistent with Hall and Hord's (1987; 1987) recommended method for users with high concern profiles in Stage 1 and 2 of the Stages of Concern. The second training had teachers use the technology innovation, again consistent with Hall and Hord's recommendations. These teachers then transported individual workstations to their own rooms and were given time to continue the learning process on their own. Over the next eight months, several other workshops were offered. Teachers were also given time away from their normal work duties to collaborate with partners or with the principal to practice using the technology.

In May 1994, Hope administered the SoCQ again to the same 16 teachers. Given the innovation and supports provided, Hope expected to see a change in teacher concerns. No teachers were found to have high Unconcerned stage scores (Stage 0), compared to four in the 1993 results. Only three teachers (compared to five in 1993) had high Information stage concerns (Stage 1). Three teachers (compared to two in 1993) had high Personal stage concerns (Stage 2). One teacher (compared to five in 1993) had high Task stage concerns (Stage 3). "Six teachers had advanced to Stage 5 (Collaboration) and three teachers were evidencing highest concerns at Stage 6 (Refocusing)" (Hall, et al., 1986, p. 155). Hope was able to again verify

these results with observation data: “The six teachers at Stage 5 were observed collaborating with other teachers in their use of microcomputer technology” (Hall, et al., 1986, p. 156).

Even though movement through the stages was evident, it was apparent that the movement was not drastic within eight months. It is known that adopters of an innovation change and progress differently (George, et al., 2006; Hall & Hord, 1987; Hall, et al., 1991). Hope’s (1986) research supported this; he wrote, “A conclusion arising from this research is that teachers [sic] involvement with technology is a process and not an overnight event” (p. 158).

Another study, focused on examining teachers and their concerns toward the use of instructional technology in the classroom, was conducted by Rakes and Casey (1990). Rakes and Casey surveyed 659 PK-12 teachers for their concerns toward the use of instructional technology in their classrooms using the SoCQ. Their study revealed the concerns of teachers when given an innovation, but not the supports or appropriate interventions to successfully adopt it. The sample population was purposely selected from teachers who subscribe to four email lists. Each geographic state had at least two respondents.

The demographics collected at the same time as the SoCQ provided insight into the process of adopting instructional technologies. Over 87% of the teachers sampled had been using instructional technologies for more than 2 years. Despite this, the results from the SoCQ indicated that the teachers had very high Self-concerns (Stages 0-2). A closer look at the demographics reveals that 49% of the participants had received 31 hours or more of technology training in the past year. It was also revealed that 31.9% of the teachers were given time for training in instructional technologies during school hours.

This demographic group is in stark contrast to Hope’s study, however. What Rakes and Casey (1990) found was that while training was provided, it was at the personal cost to the

teacher—taking time away from other personal or teaching duties. It was also revealed that the teachers received "generic" training, meaning that it did not specifically address their individual concerns or needs necessarily appropriate to their upmost concerns at the time they received the training. In compensation for this effect, the teachers relied more heavily on each other, and the SoCQ results indicated that the second-highest concerns were Collaboration (Stage 5). Because of this, when asked to respond to an open-ended question at the end of Rakes and Casey's survey, many expressed a strong "desire to learn from what other teachers know and are doing" (Riggs & Enochs, 1990, p. 14). Hall and Hord (1987, 2001) warn of this phenomenon in their research; Rakes and Casey suggest that the teachers are not necessarily collaborating, but seeking low-level self-concerns information (Stage 1: Informational) from each other if not provided the level of institutional support they require.

Summary

Hall and Hord (1987, 2001) have mentioned that the SoC is not a lock-step, linear progression. Rakes and Casey's research may support this claim, illustrating that teachers can maintain on-going personal concerns, yet experience some of the other concerns to a diminished degree. A detriment of this concerns-sharing is that an individual's concerns directly affect performance. If the concerns are heightened at the Self-concern levels (Stages 0-2), then those concerns must be removed before other higher level concerns can truly emerge:

> It is critical to note that another person cannot simply manipulate higher level concerns development. Holding and changing concerns is an individual matter. However, timely provision of experiences and resources can assist with concerns arousal and resolution, encouraging the development of higher level concerns. Providing training or other interventions that are not aimed at the appropriate concerns (e.g., attempting to force high

> level concerns) is an almost certain way to increase the intensity of lower, less desirable stage concerns. Training must target the individual concerns of teachers before moving on to concerns of how others, even their own students, will use the available technology. (Riggs & Enochs, 1990, p. 14)

According to Green (1993), it is the same when it involves technology in a higher education setting: "The challenges have less to do with products and more to do with people . . . the most important issues confronting universities over the next few years are instructional integration and user support" (p. 2). If true, change agents should be focusing on teacher or faculty concerns as the key to addressing the attitudes and perceptions they may have regarding a technology innovation while incorporating institutional support. Petherbridge (1998) supports this notion in her doctoral dissertation research:

> While introducing technology into instruction clearly depends on developing faculty member skills and providing appropriate support structures to assist them in skill development; more importantly, the successful introduction and use of technology such as LMSs may depend on addressing the attitudes and perceptions of the faculty members involved in the implementation of the innovation. (1998, p. 2)

In spite of support and access to timely information, faculty may still feel apprehension. Gandolfo (1984) explains that faculty experience resistance to any new innovation or innovation upgrade, fearing loss of established traditions and concerns about finding the time to gain an ability. However, Gandolfo (1984) mentions that finding the time to gain an ability has more to do with personal interest and self-efficacy, than anything else.

One last thing to consider -- if the change agent has the goal to *change the behavior* of the adopters and to *change their attitude* toward the innovation, this implies that some kind of

affective change must occur (Hall & Hord, 1987, 2001; Watson, 2007). At present, there is a dearth of literature and research within the innovation-diffusion realm pertaining to affective or psychological factors involved in adoption. This may be methodological; historically, diffusion strategies focused on the innovation characteristics and the effects on the rate of diffusion (Tornatzky & Klein, 1982; Clark, 1978), not on internal feelings or intrinsic motivational factors of the adopters. Given how much consideration is dedicated to understanding the innovation adopter, the CBAM SoC does not directly measure self-efficacy, although recent research has suggested that it is an avenue for study (Hall & Hord, 1987, 2001; Watson, 2007). More recently, it has been suggested that personal characteristics and other underlying psychological factors, such as self-efficacy, should be examined (Hall & Hord, 1987, 2001; Watson, 2007). After reviewing the context of self-efficacy and other models that incorporate self-efficacy, a discussion from which parallels can be drawn suggest that self-efficacy may be one of the unknown psychological factors that drive individual adopter success.

Change Models That Incorporate Self-Efficacy

Self-efficacy stems from the cognitive psychology field of the 1970s. Bandura describes self-efficacy and motivation as rooted in the realm of cognitive processes that acquires, synthesizes, and regulates behavior. In the late 1970s, Bandura noted that humans are able to envision what is possible or could happen, and suggested that the mere cognitive action of doing so "can generate current motivators of behavior" (Bandura, 1977, p. 193). Bandura (1977) also suggested that if a person is given "appropriate skills and adequate incentives … efficacy expectations are a major determinant of people's choice of activities, how much effort they will expend, and of how long they will sustain effort in dealing with stressful situations" (p. 194). Bandura later revised his own definition, suggesting that self-efficacy was more influential than

previously thought because "the types of outcomes people anticipate depend largely on their judgments of how well they will be able to perform in given situations'' (Bandura, 1986a, p. 95). Since that time, research by Bandura, Zimmerman, Pajares, and others have determined that self-efficacy can be defined as intrinsic "beliefs about one's perceived capability … to attain designated types of performances and achieve specific results" (Pajares, 1996, p. 546). Indeed, self-efficacy has been determined to have many facets to its complexity. Because of this, "self-efficacy is generally assessed at a more micro-analytic level" (Pajares, 1996, p. 546) than other constructs of expectations.

When examining self-efficacy in a micro-analytic way, expectations are one part of envisioning what is possible. Efficacy expectations are those that are postulated between the individual and the behavior. It is the self-perception of being able to do something (a related aspect of confidence). It indicates the choice of behavior towards an outcome (Bandura, 1977). There are several components of expectations that cumulatively create self-efficacy. Expectations can differ in magnitude and are perceived as levels of difficulty. They can also differ in generality in that they can be mastery skills or transferable skills. They also differ in strength, which relates to confidence and satisfaction (in turn shaping coping mechanisms). According to Bandura (1977), efficacy expectations originate from:

- performance accomplishments ("I saw it done successfully," or "I did that and I succeeded."),
- vicarious experience ("Visualize overcoming obstacles."),
- verbal persuasion ("It's just like riding a bike—you can do it."), and
- emotional arousal ("I can control potential threats.").

Studies from Bandura's (1977) work with colleagues supports that and they suggest that generalized, lasting changes in self-efficacy and behavior can best be achieved through a series of "steps": participants use powerful induction procedures to initially develop capabilities, then remove external aids to verify personal efficacy, then finally use self-directed mastery to strengthen and generalize expectations of personal efficacy.

Other researchers have also contributed to the field of motivational theory and self-efficacy. Between 1985 and 1995, researchers in the motivation field reported that self-efficacy is more predictive of interest than previous achievements or high-scoring assessments (Pajares, 1996). Zimmerman confirms this, stating that "self-efficacy has emerged as a highly effective predictor of student's motivation and learning" (2000, p. 82). According to Zimmerman (2000), in a study conducted in 1997 that compared students with high self-efficacy compared to those who did not, the role of self-efficacy in academic motivation has proven to influence choice of activities, level of effort, persistence, and emotional reactions. The results from two studies of mathematics students reveal that students' self-efficacy beliefs are predictive of the amount of effort they invest (Schunk, 1987; Schunk & Hanson, 1985; Schunk, Hanson, & Cox, 1987).

This indicates that there are a few possibilities to consider when evaluating a learner for predictors for success. If a person is learning to do something, he must develop some amount of self-efficacy. Bandura stated that this could be done by having the learner observe. The learner can watch it be modeled or demonstrated, and instructed to visualize himself doing it correctly. The learner should also associate other supportive or like skills to the potential task, and be receptive to positive encouragement or persuasion. If the learner could choose and perform the behavior correctly and repeatedly, it would be suggested to remove some of the aids previously provided. As he masters the task or skill, he gains an overall and lasting sense of confidence,

satisfaction, and perceived ability. As Schunk (2012) described, "Compared with students who doubt their learning capabilities, those with high self-efficacy for acquiring a skill or performing a task participate more readily, work harder, persist longer when they encounter difficulties, and achieve at higher levels" (p. 250).

Literature in self-efficacy continues to suggest that there are different types of self-efficacy that may drive our success in some areas versus others. Schunk and Zimmerman (2009), suggest that "self-efficacy judgments are contextually specific in that they refer to specific performance situations" (p. 10-11). Many studies look at self-efficacy of student academic achievement, but in fact, "self-efficacy has been applied to teachers as well as to students. *Teacher (or instructional)* self-efficacy refers to personal beliefs about one's capabilities to help students learn … Teachers with higher self-efficacy are apt to develop challenging activities, help students succeed, and persist with students who have difficulties" (Schunk & Pajares, 2009, p. 38). Additional research by Ertmer and Ottenbreit-Leftwich (2010), Morrel and Carroll (2010), and others investigating teaching self-efficacy confirms this. The same can be said about self-efficacy as a construct related to computer anxiety (Saadé & Kira, 2009; Shriner, Clark, Nail, Schlee, & Libler, 2010). Computer anxiety can be defined "as a tendency of individuals to be uneasy, apprehensive, or fearful about current or future use of computers" (as cited in Saadé & Kira, 2009, p. 179) and is very similar to concerns that are expressed by users adopting technology. Saadé and Kira (2009) explained, "Previous research has confirmed that high levels of computer anxiety reduce levels of self-efficacy which in turn lowers computer-based performance attainment" (p. 180). They suggest that "qualitative feelings a person ascribes to some previous computer experience need to be understood" since "this construct might dominate as a predictor of successful and satisfied usage" (p. 186).

Research in self-efficacy by Chen, Gully, and Eden (2001) and Chen, Gully, Whiteman, and Kilcullen (2000), also argue that general self-efficacy exists as a "a more motivational form of self-evaluation" (Chen, Gully, and Eden, 2001, p. 353). Furthermore, general self-efficacy can be defined as "individual differences in people's tendency to view themselves as capable of meeting task demands in a wide variety of situations" (Chen, Gully, Whiteman, & Kilcullen, 2000, p. 838) and "strongly relates to motivational constructs and processes" (Chen, Goddard, & Casper, 2004, p. 353).

When measuring a particular self-efficacy, Schunk and Pajares (2009) note that "contextually bounded, reasonably precise judgments of capability carefully matched to a corresponding outcome afford the best prediction of behavioral outcomes (p. 50). Schunk and Pajares (2009) suggest that measurement of self-efficacy should be:

> … tailored to the domain(s) of functioning being analyzed and reflect the various task demands within that domain. In the final analysis, evaluating the appropriateness and adequacy of a self-efficacy measure will require making a theoretically-informed and empirically sound judgment that reflects an understanding of the domain under investigation and its different features, the types of capabilities the domain requires, and the range of situations under which these capabilities might be applied. (p. 50)

For all types of self-efficacy involved, Bandura (1977), Zimmerman (2000), Schunk (1987), and Parajes (1996) state that if the learning is of genuine interest to the learner, he or she is motivated and will spend more time doing it and will sustain a higher tolerance to stress or frustration. Given these conditions, it could be said the learner is motivated and predictions based on his or her specific self-efficacy should support that. Even then, the performer must develop enough self-efficacy to believe they can perform the task successfully and only with that

may it be possible to predict his or her success in performing the task. Again, it is noted that "people work best when they are operating in a personal domain of interest in which they are willing to engage in prolonged comprehension-fostering activity" (Brown, 1988, p. 316). This makes sense when considering how long learners may have to repeatedly practice and endure the learning to finally gain the reward of success. In many ways this echoes the experience of users adopting an innovation, and leads us to consider models that also examine self-efficacy.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is the diffusion model widely used for information systems or information technology innovations in the corporate or business sector. Also based upon Rogers' *Diffusion of Innovations*, this model "attempts to predict individual adoption and use of ITs" (Venkatesh & Bala, 2008, p. 276). While the TAM is successful at measuring user perceptions of ITs and using that information to improve user interface designs, it cannot explain the disparity between individuals' intentions to use an IT versus actually using it (Venkatesh & Bala, 2008). The TAM is also known to be difficult to use by practitioners looking for a pragmatic, systematic, prescriptive approach. What it does measure (to a limited degree) are elements of intrinsic motivation and technology self-efficacy; however, these results are often used in refining the technology innovation to be adopted, rather than being used to study the adopters themselves. Regardless, the TAM remains a favorite among those responsible for software technology adoption in corporate and business organizations and enjoys widespread use.

The TAM has been in use since 1985 when Fred Davis completed his thesis at MIT entitled, "A technology acceptance model for empirically testing new end-user information systems: theory and results." In 1989, he and his colleagues acknowledged a need to identify

smaller, influential components involved in technology and user adoption. They focused on a user's *perception of innovation usefulness* and *ease-of-use*, comparing those to the user's actual use of the innovation. For more than ten years, TAM studies continued to inquire into how adopters perceive the usefulness and use of technological change, never deviating far outside of those two elements. In 2000, Venkatesh (2000; Venkatesh & Davis, 2000) identified a missing element from the TAM model that was present in other diffusion models in other disciplines: intrinsic motivation and technology self-efficacy.

Psychological factors and predictors. For the greater part of 15 years, the TAM research largely focused upon breaking the technology innovation into smaller and smaller parts to identify ways to improve adopter acceptance while also looking into ways to ease the adoption. In an effort to uncover what drives users to adopt technology, Agarwal and Prasad (1998) pursued a study to answer, "Why do some individuals readily adopt new information technologies while others reject them?" Within the realm of that model, they proposed a new construct, *personal innovativeness*, to identify individuals who are likely to (a) adopt information technology innovations earlier than others, and (b) to act on their beliefs or perceptions, and (c) to share their results with others. While this is not wholly different from an early-adopter opinion leader in Rogers' *Diffusion of Innovations* model, *personal innovativeness* considers how perceptions by the user are formed and the subsequent role they play in the user's mind, plus how they intend to use it. Breaking down the model to look only at the actual innovation's characteristics, they sought to identify the user's intentions of use, as opposed to "an ex post descriptor of the behavior" (Agarwal & Prasad, 1998, p. 206). They determined that a user's domain-specific innovativeness has significant influence on behaviors in a narrow domain of activity and can be measured by self-reported means.

Testing their theory on MBA students using the World Wide Web (which at the time had not yet been institutionalized for work, school, education, or pleasure), they developed a self-reported Likert scale, the Personal Innovativeness in Information Technology survey. The survey had been deemed to have a high-internal reliability (Cronbach's alpha 0.84) and collected "insights into the likelihood of an individual choosing to interact with any [Information Technology] or not" (Agarwal & Prasad, 1998, p. 209). They also employed the well-established Computer Playfulness Scale developed by Webster and Martochhio (1992) for cross-reference to measure how an individual will behave when interacting with a technology.

The results indicated that only one of the perceptions—that of perceived compatibility—exhibited some influence on the relationship of adoption. Therefore, perceived compatibility is the degree to which an innovation is perceived as being consistent with perceived values, past experiences, and the needs of the potential adopter that influences the decision to adopt the innovation. (Rogers, 2003) Agarwal and Prasad (1998) recommended that further studies be conducted with their instrument; they also advised other researchers to address affective concerns, examining motivational factors through additional research using different samples and different information technology innovations.

Indeed, careful research into improving perceptions of usefulness and ease of use have improved human-computer interactions over the years, but it has not singularly solved the technology adoption problem that continues to exist (Venkatesh, 2000; Venkatesh & Davis, 2000, Venkatesh & Bala, 2008). In 2000, Venkatesh adjusted this focus when he explained that in forming a system-specific perceived ease of use concept in a technology design:

> individuals anchor on key individual and situational variables that relate to control, intrinsic motivation, and emotion. With increasing direct experience with the target

> system, individuals adjust their system specific perceived ease of use to reflect their interaction with the system. (p. 343)

This means that when IT is designed and rolled out, a significant amount of consideration has already gone into what constitutes "easy to use." However, Venkatesh points out that not everyone will have the same concept of "ease" nor will it always produce favorable perceptions. Venkatesh (2000) and Venkatesh and Bala (2008) instead suggest looking at the individual learner's differences and considering how to improve learner interest and confidence. This requires a new focus upon user control, intrinsic motivation, and emotion. The suggestion made here by Venkatesh and colleagues is that users must be engaged in a way that intrinsically motivates them (Agarwal and Prasad, 1998; Venkatesh, 2000; Venkatesh & Bala, 2008; Saadé & Kira, 2009). Only then will users work longer and harder while developing their self-efficacy and confidence as they go.

Transtheoretical Behavioral Change Modification (TBCM) model

Prochaska's (1979) Transtheoretical Behavioral Change Modification (TBCM) model is both a stages of change model and diffusion model used in the health behavior and behavior modification discipline. Like most diffusion models, it is in part based upon Rogers' *Diffusion of Innovations.* However, it borrows more heavily from the theory of therapeutic content, processes of change, and Bandura's "comprehensive model of change in which effective therapy is seen as producing a cognitive restructuring in the individual's sense of self-efficacy" (Prochaska & Di Clemente, 1982, p. 277). The TBCM is commonly used to measure (in an effort to predict) success in adopting new health habits such as quitting smoking, exercising, or using contraception.

Development of the model. Unlike Rogers five-stage diffusion model, the original TBCM model consisted of four stages: contemplation, determination, action, and maintenance. Prochaska and DiClemente (1982) found that the model lacked an understanding of the deeper processes involved in embodying personal change, so they suggested a new construct of stages that also factor self-efficacy into the model. Today, there are several more stages in the TBCM model (pre-contemplation, contemplation, preparation, action, maintenance/relapse, termination) and the inclusion and testing for self-efficacy is fully assumed.

Psychological factors and predictors. Already mentioned is the fact that the TBCM is a stages of change model that specifically includes key concepts and notions regarding human behavior in an explanation as to why and how behaviors change. It is also a diffusion model, demonstrating the different stages that adopters go through as they accept or resist an innovation (such as learning a new habit). In the TBCM, self-efficacy is currently known to be the best predictor of behavior, and Marcus and Owen (1992) research using ANOVA for the data analysis suggest that self-efficacy may actually be clear indicators of *stage change readiness*.

Stage change readiness is a user's internal state of "being on the cusp" between one stage and the next. For example, a patient who is diagnosed with obesity may be in the preparation stage, meaning that the patient is preparing to make a specific change. The patient may be sampling low-fat foods and preparing food menus. The next stage would be the action stage. In this stage, the patient has decided to pursue the change and to enact the plan. If a measurement of the patient's self-efficacy is taken at the preparation stage and it results in a high score, this indicates that the patient is indicative of *stage-change readiness*--that the patient is intrinsically motivated and confident to begin the change. In several research studies, high self-efficacy corresponds to a higher resolve and sustaining period in the maintenance stage than those with

low self-efficacy scores (Armstrong, Sallis, Hovell, Hofstetter, 1993; Jordan-Marsh, 1985; Marcus, Banspach, Lefebrvre, Rossi, Carleton, Abrams, 1992; Marcus & Owen, 1992; Marcus & Simkin, 1994; Sniehotta, Scholz, & Schwarzer, 2005).

Why has TBCM decided upon self-efficacy and intrinsic motivation as the underlying psychological factors of study? In general, self-efficacy can be described as the influential belief one has about his or her capabilities to successfully perform a specific task. Intrinsic motivation performs a role in motivating a person to do the desired outcome--it is "the internal drive" to engage or perform an action. These largely come from the foundation upon which the TBCM was built upon. TBCM comes from psychological behavioral models, receiving direct influence from psychological and motivational research by Bandura, Frank, and Gurman.

Relationship of TBCM to Self-Efficacy. In the earliest years of the TBCM model, DiClemente, Prochaska, and Gibertini (1985) conducted a study that examined self-efficacy in smoking cessation behaviors of 957 volunteers. They issued a 31-item survey to test for temptation and confidence (self-efficacy) and sought to find correlations between the self-efficacy and the five stages of self-change: immotives, contemplators, recent quitters, long-term quitters, and relapsers. Findings indicated that the subject groups had significant differences in total self-efficacy scores and that self-efficacy expectations showed relationships with the smoking history variables of the pros and cons of smoking. DiClemente et al. (1985) were able to determine that self-efficacy and changes in the stages could be made:

> … efficacy expectations emerged as self-evaluations relatively independent of other cognitive, behavioral, and trait dimensions but related in theoretically meaningful ways …self-efficacy was an important and relevant aspect of self-change. Subjects' expectations of their ability not to smoke over a wide range of situations accurately

represented their actual status as smokers and nonsmokers as well as their time in the maintenance cycle. (p. 195)

This provided the initial concept that self-efficacy could be used as a predictor for behavior and to identify interventions toward forward progress through the model. As DiClemente et al. wrote, "the *value of the self-efficacy construct is in behavioral prediction*, not classification" (*emphasis added*, 1985, p. 197).

In 1995, Galavotti, Cabral, Lansky, et al. (1995) conducted a research study of 296 women using contraception at-risk for contracting HIV. Galavotti et al. conducted this study in an effort to assess the applicability of the TBCM model, but included in the study were the variables of self-efficacy and decisional balance scales. What they found was that self-efficacy and decisional balance scales were highly reliable (alpha greater than 0.80). From the ANOVA results of the study, "self-efficacy scores increased after the precontemplation stage and continued to increase with each stage" (1995, p. 575). With significance at .001 for all self-efficacy results, the researchers were able to determine that "scores rose significantly across [four] stages, from precontemplation to maintenance" (1995, p. 570). Discussion centered around the construct of "strong principle of progress" which "holds that progression from precontemplation to action is a function of the increase of approximately one standard deviation in the pros of a healthy behavior change" (1995, p. 576). What this indicates is that personal self-efficacy may be the biggest factor which prompts a user to action.

In 1992, from the discipline of health and exercise, Marcus conducted several studies applying and using Prochaska and DiClemente's (1982) TBCM model. In each of her studies she used ANOVA for analysis and reported that self-efficacy was a driving predictor of behavioral change (Marcus, et al., 1992; Marcus, et al., 1998; Marcus & Owen, 1992; Marcus & Simkin,

1994). She also contributed to the findings by reporting on the concept of *motivational readiness*, *self-efficacy*, and *decision-making* for exercise (1992). In her research of 1093 employees in Providence, Rhode Island and 801 employees in Adelaide, Australia, she found consistency between the sample groups. Tests of self-efficacy reliably differentiated most pairings at different stages. Precontemplators and Contemplators had the lowest self-efficacy scores whereas those in the Maintenance stage had the highest scores. Across all stages a "clear differentiation" for self-efficacy was revealed. Again, it was suggested that self-efficacy could act as a predictor of behavioral stages and could be used to prevent stage "slippage" by targeting users with appropriate and specific interventions:

> It is particularly important to tailor exercise interventions, given that the reason so many people drop out of exercise programs may be due to mismatches between their stage and the typical action-oriented programs that are offered (Barke & Nicholas, 1990). With a more clear understanding of peoples' self-efficacy, decision making, and stage of readiness to be physically active, it is likely that fewer mismatches would occur and thus more individuals may adopt and adhere to appropriate exercise regimens. (Marcus & Owen, 1992, p. 13)

In 1993, Armstrong, Sallis, Hovell, and Hofstetter conducted follow-up research on the topic of exercise. They recorded a baseline measure of self-efficacy for all participants. For the self-efficacy measure, the researchers used a three-item scale on which participants rated their confidence to exercise given certain demands. For this, a 5-point Likert scale was used and the scores were averaged to form the self-efficacy score. Regarding demographic data and the stages of change in the TBCM model, Armstrong et al. used regression analysis methods and compared Contemplators and Precontemplators of exercise across several demographic

variables. Armstrong, et al. then conducted a multivariate analysis to examine the effects of these variables across groups (stages) "after controlling for differences in age, gender, and self-efficacy" (Armstrong, et al., 1993, p. 396).

After this multivariate analysis, what the researchers found was that in addition to self-efficacy being a predictor of exercise behavior, the "baseline stage of change was not only a significant predictor of future exercise but was a predictor of approximately equal magnitude with self-efficacy" (Armstrong, et al., 1993, p. 397). What DiClemente, et al. (1990) and Armstrong, et al. (1993) both confirmed was that the amount of progress an individual makes in treatment is a function of his or her stage of change since the baseline. Therefore, self-efficacy is not only a predictor, but also grows with confidence and reaffirming experience. These appeals to the affective motivator of confidence may be one such factor for increasing self-efficacy scores (Bandura, 1977; Bandura & Schunk, 1981).

Congruence of Models

Watson (2007) postulates in his own research that the TBCM can be drawn in parallel to Rogers' original five-stage, innovation-decision process. (See Figure 5.) The CBAM, being an innovation-diffusion model descended from Rogers' model, goes one step further and acknowledges that personal, affective concerns exist and influence adoption in higher education. The CBAM already articulates the known stages for which behavioral change comes about, just like the TBCM model. The difference is that the TBCM model closely aligns and specifically postulates that self-efficacy can be used to effectively predict success. While CBAM's own Stages of Concerns can reflect where learners are in their concerns, it cannot predict their ability, willingness, indication, or success for the next expected change.

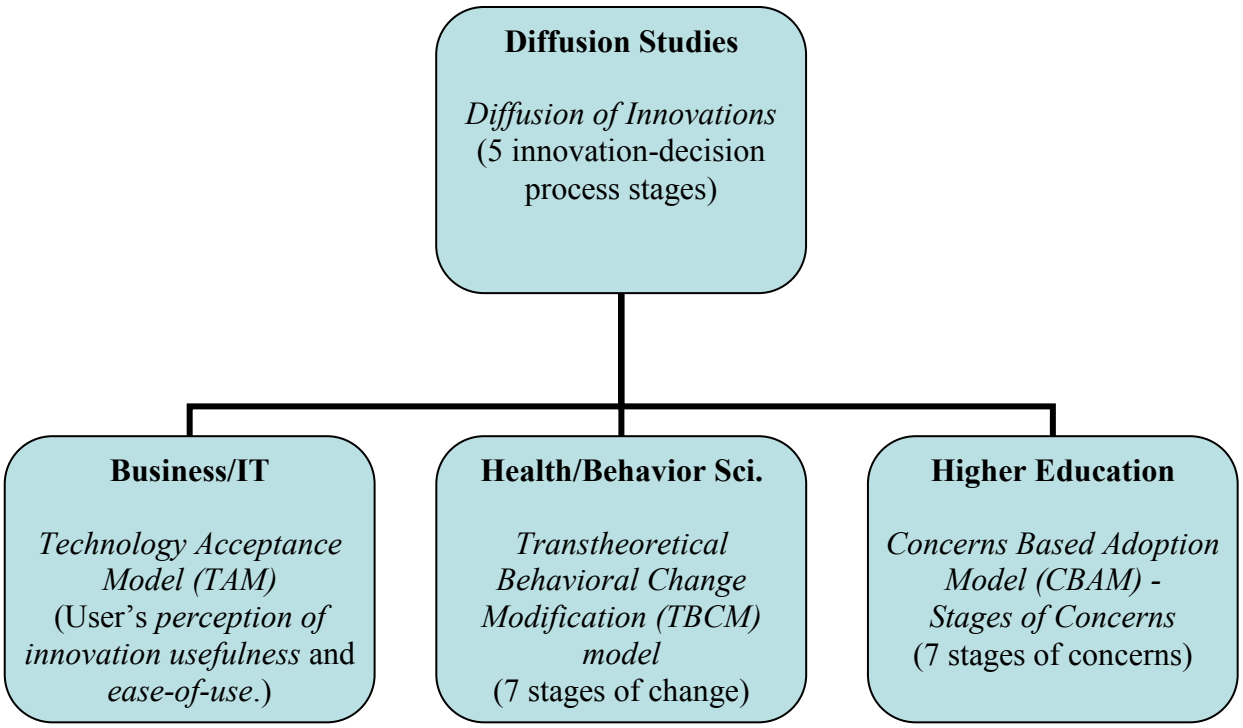

Figure 5. Innovation diffusion models from Business/IT, Health and Behavior Science, and Higher Education share roots with Rogers' (1962) original *Diffusion of Innovations* model.

A quick review of Watson's (2007) research may help explain the relationship between these two models. In 2007, Watson conducted research to determine how faculty development and faculty adopter's self-efficacy were meeting the social, cultural, and technological changes at the time. As part of his study, he reviewed adopters' numerous demographic variables against three self-efficacy constructs: college teaching, teaching with technology, and general self-efficacy. He conducted analysis using ANOVA, Pearson-r, and multiple regression analysis for relationships between self-efficacy and the five stages of adoption within Rogers' (2005) revised *Diffusion of Innovations* model. (Rogers' *Diffusion of Innovations* model includes a five-step innovation-decision process which is a general model of user-adoption from which the TCBM and CBAM Stages of Concerns base their nuanced stages of change upon.) From Watson's (2007) study he reported that "when considering teaching with technology self-efficacy and

[Rogers'] instructional technology-based innovation-decision stage, it was found that this type of self-efficacy differs significantly between most stages and consistently increases from the knowledge stage through the confirmation stage." This means that in each stage of Rogers' model, the teaching with technology self-efficacy was lower at the early stages and increased as the adoption of the innovation was closer to success; adopters' teaching with technology self-efficacy was weakest when they were unaware of—or just beginning to adopt—an innovation, and strongest for those who were actively using the innovation.

This parallels what is seen in the research from the health and behavior sciences (TBCM). Since Watson delved into the TBCM in his literature review, he recognized this. After collecting and reporting on his research data, he explicitly noted the relationship between teaching with technology self-efficacy and the stages found within Rogers' innovation-decision process. In referring to his findings of a relationship between Rogers' original diffusion model and self-efficacy, Watson (2007) stated that, "it is reasonable to suspect that they would be generalizable to any field, discipline, or context in which behavior change or innovation adoption is being articulated in terms of a stage of change model that has similarity to the models under consideration" (p. 148). Watson (2007) suggests further investigations into the relationship between self-efficacy (as seen in the stages in the TBCM model) and the stages of Rogers' innovation-decision process, or any similar model.

Since CBAM is descended from Rogers' model, it inherently carries much of the same structure and content. However, the CBAM has been modified and refined to better address the desire for an adoption model for higher education innovations. And as that CBAM focuses upon the affective characteristics of an adopter, it's unsurprising to learn that the affective attributes of learners were key in the original development of the CBAM (George, et al., 2006). In 1997,

Anderson stated that "a sound understanding of the affective and behavioral dimensions of change … remains as relevant today as it was 20 years ago, when CBAM theory was first being developed" (Anderson, p. 332). In 2001, researchers involved in the creation and continuing validity of the CBAM model and its components (George, et al., 2006; Hall, Dirksen, & George, 2006; Hall & Hord, 1987, 2001; Hord, et al., 2006) agreed that there is an underlying question "of interesting speculation … Does change come about simply as a result of increasing experience with the innovation, or is it related to affective aspects of the person?" (Hall & Hord, 2001, p. 94) Indeed, CBAM's foundation of the "human dimension of change" is largely congruent to the TBCM model.

Although the TBCM model has fewer stages than Hall and Hord's (George, et al., 2006; Hall & Hord, 1987) Stages of Concern model, it parallels and speaks to the affective components within each model. To date, the TBCM model consists of the following stages: pre-contemplation, contemplation, preparation, action, maintenance/relapse, and termination--this last stage is often excluded due to the impossibility of zero temptation and 100% self-efficacy (DiClemente, et al., 1985; Galavotti, et al., 1995; Prochaska & DiClemente, 1982; Prochaska, DiClemente, Velicer, & Rossi, 1992; Prochaska & Velicer, 1997). The CBAM seven Stages of Concern are: unconcerned, informational, personal, management, consequence, collaboration, and refocusing (George, et al., 2006; Hall & Hord, 1987). Parallels are drawn in Figure 6.

With the CBAM's long-standing history of use in higher education institutions and a disposition toward affective concerns, it does make it an ideal innovation-diffusion model to use (see Table 1). Given the congruence between models and upon looking at Watson's study, it is reasonable to conclude that for an innovation study, the CBAM SoC could be used in lieu of Rogers' model (as used in Watson's research) and also evaluated for any relationships between

stages of concerns and psychological factors (i.e., self-efficacy) that may affect faculty adoption of an innovation.

Previous Research Analysis

Before further research into self-efficacy as a predictor of stages of concerns is conducted, or for any statistically significant relationship that may exist, it is prudent to take a close, critical look at the methods for data analysis previously used in the cited research studies. Marcos and Owen (1992) used straight correlation comparisons and ANOVA to determine the relationships among stages of change and self-efficacy. It is important to note that they did not seek to determine if self-efficacy was a predictor of behavior; they only *implied* and *suggested* that it was possible. Watson (2007) conducted research that investigated the relationships of the three self-efficacies to stages of Rogers' innovation-decision process. He used ANOVA, Pearson-r, and multiple regression analysis where multiple regression sought to determine if "all three self-efficacy types were seen as predictor variables" (p.143). He reported that when using ANOVA, the "innovations-decision stage did vary significantly based upon one's level of college teaching self-efficacy … [and] upon one's level of teaching with technology self-efficacy … [and] upon one's level of general self-efficacy" (p. 142-143). His Pearson-r analysis (used to reveal the strength of the relationships) revealed that the correlation between self-efficacy type and innovation-decision stage was predominantly "accounted for by teaching with technology self-efficacy," (p. 143), although college teaching self-efficacy and general self-efficacy were also statistically significant. Watson also performed "multiple regression, where all three self-efficacy types were seen as predictor variables and instructional technology-based innovation-decision stage was the criterion" (p. 143). What he found was that "22.4 percent of the variance

in instructional technology-based innovation-decision stage could be explained" (p. 146) by the collusion of all three self-efficacies.

Although both research studies presented here include valid methods of statistical research, it was proposed that a consultation with the local statistical lab could provide insight into data analysis options. After periodic meetings with the statistical staff spanning a year-and-a-half, it was determined that nominal logistic regression provided the best statistical analysis for the questions posed. Nominal logistic regression statistical analysis reveals any relationships or correlations; it examines the relationship between a categorical dependent variable (consisting of three or more unique values) and independent variables. This works very well for determining predictive relationships and is appropriate for this research. Users' Stages of Concern are nominal variables (not in any particular order, like abstract categories). Additionally, the Stages of Concern consist of three categorical groupings of SELF (stages 0-2), TASK (3), and IMPACT (4-6) which acted as the categorical dependent variables upon which the independent variables (the various self-efficacies) were run against.

Table 1. Advantages of each Innovation Adoption Model.

Transtheoretical Behavioral Change Model (TBCM) Stages of Change	**Concerns Based Adoption Model (CBAM)** Stages of Concern
Descriptive model resulting from behavior change studies within the health and behavior science field.	Descriptive and semi-predictive model designed to address the systemic organization of higher education.
Self-efficacy suggested as predictor of adopter performance	Provides known interventions for change agents in higher education to address recognized concerns
Measures adopter Stages of Change	Measures adopter Stages of Concerns

Summary

The selected models from higher education (CBAM), Technology (TAM), and health and behavioral health (TBCM) all use diffusion models which are applicable to their disciplines. These models and their outcomes provide insights into the important aspects of user adoption of an innovation: (a) identifying the moment that change agents will have the most effect, (b) identifying adopter's underlying psychological factors (motivation, self-efficacy, personal beliefs); and (b) providing a comparison between the underlying psychological factors and the outcomes. From all studies reported, there is strong indication that self-efficacy may be a predictor of current circumstance and future success when adopting and using innovations.

Transtheoretical Behavioral Change Model (TBCM) Stages of Change			Concerns Based Adoption Model (CBAM) Stages of Concern			
7	**Termination**	Often excluded due to the impossibility of zero temptation and 100% self-efficacy.	IMPACT	6	**Refocusing**	Exploring more benefits. Making major changes or seeking replacement.
6	**Relapse**	Resumption of old behavior. (Evaluate trigger, motivation, and coping strategies)		5	**Collaboration**	Coordinating and cooperating with others.
5	**Maintenance**	Continued commitment to sustaining new behavior. (6 months – 5 years)		4	**Consequence**	Concerned about the innovation's impact on students.
4	**Action**	Practicing new behavior. (3 – 6 months)	TASK	3	**Management**	Using the innovation with support from resources.
3	**Preparation**	Some experience with making the change and testing out the new behavior. (Planning to act within 1 month)	SELF	2	**Personal**	Uncertain, unclear, unsure. Considering personal conflicts.
2	**Contemplation**	Ambivalent about change. (Not considering change within the next month)		1	**Informational**	Not worried. Gaining awareness of the innovation.
1	**Pre-Contemplation**	Not considering any change. (Ignorant of change.)		0	**Unconcerned**	Unaware or unconcerned about the innovation.

Figure 6. Parallels between TBCM (Prochaska & DiClemente, 1982) and CBAM SoC Model (George, et al., 2006).

Summary

As stated prior, higher education institutions for several decades have attempted to adopt a variety of pedagogical and technological innovations to varying levels of success. Rogers' *Diffusion of Innovations* model provides the grandfather framework for how adoptions take effect. The Transtheoretical Behavioral Change Modification (TBCM) model includes elements in the affective domain, studying motivation and self-efficacy as key predictors of performance and action. The CBAM's long-standing history as a semi-predictive model used by change agents in higher education makes it an ideal innovation-diffusion model to use, especially since it incorporates adopters' affective concerns. Despite this, the CBAM SoC model does not yet include a study of self-efficacy or other underlying psychological factors involved in individual decision-making and action follow-through. However, it has been suggested by multiple researchers (Hall and Hord, 1987, 2001; Watson, 2007), including some of those who founded the CBAM, that more research into this domain is necessary. Upon reviewing Watson's study, it is reasonable to conclude that the CBAM SoC could be investigated (in lieu of Rogers' model as used in Watson's research) for relationships between stages of concerns and psychological factors (i.e., self-efficacy) that may affect faculty adoption of an innovation.

If this is true, we should take into consideration the findings from Watson's research, Hall and Hord's research, and TBCM research regarding self-efficacy, technology, higher education, and change/adoption. Like models from other disciplines, it may be time for a diffusion model specific to higher education to not only identify what a faculty member's concerns are, but how to proactively identify adopter needs and to evaluate whether or not self-efficacy can be helpful predictors of performance and success. Upon a review of all the

literature that has been explained here, it is suggested that various self-efficacies should be the psychological factors for study.

Indeed, parallels among innovation diffusion models across several disciplines suggest not only investigating self-efficacy, but investigating it because self-efficacy may be responsible for an adopter's *readiness to change*. As mentioned previously, only "sister" models in other disciplines currently delve into examining self-efficacy as a possible underlying psychological factor, but the Concerns Based Adoption Model (CBAM) and its Stages of Concerns (SoC) component is a very effective and widely used higher education innovation-diffusion model. The CBAM SoC meet many change agents' needs and include prescriptive elements well-suited for use in the higher education structure and system while hinting at affective domain characteristics.

For this reason, the Concerns Based Adoption Model (CBAM) was selected as the innovation model under study in lieu of Rogers' more general Diffusion of Innovations model or the very discipline-specific Transtheoretical Behavior Change Model. From the CBAM and SoC, only the Stages of Concern Questionnaire (SoCQ) was used due to long-standing reports of it being a sensitive and reliable measure of stage representation (George, et al., 2006; Hall & Hord, 2001).

Lastly, this research examined the relationship between the Stages of Concern and three types of self-efficacies (general, college teaching, and teaching with technology); special attention was given to correlations between self-efficacy and the stages of concerns to reveal relationships that might indicate stage representation or predictors of stage change movement (or a *readiness to change*).

For the purposes of this study, this research also identified the stage of the innovation, Google Apps, at a large university institution. Google Apps allows for asynchronous and synchronous remote collaboration among users. Users can share documents, make and record document edits, enable live video chats, screenshare and record sessions, and integrate email and calendar functions. Pedagogically, Google Apps has inexpensively streamlined how digital collaboration takes place. Given the rise in distance education, flipped-classroom strategies, and educational outreach and student engagement, the desire for this type of remote collaboration has grown increasingly strong. (Johnson & Brown, 2012) Currently, Google Apps holds widespread adoption and use by many educational institutions and other organizations. (Mousannif, Khalil, & Kotsis, 2013)

Chapter III: Methodology

This chapter expands upon the purpose statement and research questions for this study. It also includes a description of the study participants, data collection, and how the study was conducted. Furthermore it also describes the research design, procedure, instruments, and proposed data analysis.

Purpose Statement

The purpose of this study was to examine the relationship between the Stages of Concern and three types of self-efficacies (general, college teaching, and teaching with technology).

Research Questions

Based upon the literature, the following research questions were investigated:

Innovation Identification

1. Which stage of Rogers' *Diffusion of Innovations* curve is the chosen innovation in?

Identify Stages of Concern (SoC)

2. What is the Stages of Concern profile for instructors in the use of the innovation?

Self-Efficacy and SoC

3. What is the relationship between instructor general self-efficacy and the categories of the Stages of Concern (SoC)?
4. What is the relationship between instructor teaching self-efficacy and the categories of the Stages of Concern (SoC)?
5. What is the relationship between instructor technology self-efficacy and the categories of the Stages of Concern (SoC)?

In this quantitative research design, one survey instrument (a questionnaire) was administered. Demographic data were collected concurrently with the data sets of self-efficacy

(for general, college teaching, and teaching with technology), and the Stages of Concern. The data were analyzed using chi-square goodness-of-fit test and nominal logistic regression in order to identify any possible demographic bias. The chi-square goodness-of-fit test was used to determine how much the sample population represented the actual population at the institution. The nominal logistic regression statistical analysis revealed any relationships or correlations that existed between self-efficacy and the Stage of Concerns under study, which may suggest an adopter's readiness to change.

Population Profile and Setting

The target population for this study included all actively teaching faculty at a large, land-grant university located in the mid-Atlantic region of the United States. The research took place during the end of Fall 2012 through to the beginning of the Spring 2013 semesters, and involved faculty listed as an instructor with the college Registrar or with the institution's instructional development center.

Based on previous institutional statistics, there was the potential for approximately 3,128 *instructors* available in the population (considering tenure-track faculty, non-tenure track faculty, other faculty, and graduate teaching assistants (GTAs)); however only actively teaching *faculty* (those with instructional responsibilities) were considered, and not GTAs. For Fall 2012, the Office of Institutional Research and Effectiveness provided demographic data showing 1,713 (tenured, tenure-track, and non-tenure track) full-time faculty. Table 2 provides information regarding instructional faculty rank at the university.

The numbers of full-time faculty may not accurately reflect all of the teaching faculty who may teach only a class or two any given semester; however, these population estimates

provide information for determining if the study respondents were representative of the actual population.

Table 2. Faculty Rank Percentages at Sampled Institution (Fall 2012).

Rank	Percentage
Professor	32.75
Associate Professor	29.54
Assistant Professor	18.56
Non-Tenure Track Faculty (Instructional, Adjunct, Academic /Professional)	19.15

Of the 1,713 targeted full-time faculty, 169 participants submitted responses. However, only actively teaching faculty with instructional responsibilities were desired, so GTAs and past instructors were excluded; 150 responses remained for a response rate of 8.75%. Each of the demographic questions was missing at least one response, but none were missing more than six. Like Watson (2007) discussed in his research, it's possible that some participants may have felt that reporting their age, sex, and other identifying attributes would compromise their anonymity. Otherwise, the data are reported below. All responses and descriptive statistical data can be found in Appendix F.

Overview

One-hundred-and-fifty participants, from at least eight college departments, ranging in age from 20-to-over-70 years old, participated in this study. Of those, 46 percent (n=69) were

male, 51 percent (n=77) were female, and 2.7 percent (n=4) provided no answer. Those holding Doctorate degrees consisted of 73.3 percent (n=110), while 20 percent (n=30) held Master degrees. Two percent (n=3) held Bachelor degrees, 2.7 percent (n=4) held other degrees, and 2 percent (n=3) provided no response. Regarding computer skills, 98.7 percent (n=148) rated themselves at or above "Average." Those that rated themselves "Below Average" were only 1.3 percent (n=2) of the population, and 2 percent (n=3) failed to provide responses. A majority of participants at 60.7 percent (n=91) have a preference for Windows-based computers.

Sex and Age

Females were roughly 51 percent (n=77) of the responses and males consisted of 46 percent (n=69) of the reported demographic group. There were six options available for selection regarding age ranges and the distribution of the ages with 84.7 percent (n=127) falling between 30-39, 40-49, and 50-59 years of age.

Degree, Rank, and College

Out of the 150 respondents, a majority of 73.3 percent (n=110) participants held Doctoral degrees. Twenty-percent (n=30) held Master degrees. Regarding rank, over 54 percent (n=81) of the responding participants hold the rank of Professor (14.7 percent), Associate Professor (25.3 percent), or Assistant Professor (14 percent). The remaining 46 percent (n=69) faculty consist of Academic Professional faculty (12.7 percent), instructional faculty (12.7 percent), adjunct faculty (10.7 percent), and other faculty (8.7 percent). The complete list of respondents' professional rank can be found in Table F4.

Out of 150 respondents, all eight colleges were represented. The highest number of participants reported being from Liberal Arts and Human Sciences with 34.7 percent (n=52). The next largest groups reported Engineering having 16 percent (n=25), Agriculture and Life

Sciences having 12 percent (n=18), and Science having 10.7 percent (n=16). The remaining participants reported colleges from Business with 6.7 percent (n=10), Architecture and Urban Studies with 5.3 percent (n=8), Natural Resources with 5.3 percent (n=8), and Veterinary Medicine with 4.7 percent (n=7). Four percent (n=6) of participants did not provide their college of instruction. The breakdown of colleges in which respondents most often teach can be found in Appendix F, Table F7.

Goodness of Fit

Nearly all of the participants provided their faculty rank. A chi-square goodness of fit test for rank was applied to the participants' responses. This revealed the level of representation of the larger teaching population. The Office of Institutional Research and Effectiveness provided demographics and statistics for the institution (see Table 2). This included information about the sub-population of full-time teaching instructors and professors. These data were used to anticipate an expected number of responses from the various groups. The data in Table 2 shows the expected and observed responses for this teaching sub-population.

The null-hypothesis is that the sample population is the same as the larger potential sample population. The p-value is < 0.0001 which is less than 0.05, which rejects the null hypothesis. Alternatively, one can look at the resulting chi-square value which is 74.0256 with three degrees of freedom. The critical value at the 0.05 level with df = 3 is 7.815. Since the calculated chi-square value of 74.0256 is greater than 7.815, it can be concluded that this sub-population of respondents is not representative of the larger population of professors and instructors at this institution. Forty-six percent represented non-tenure track faculty compared to the expected 19 percent.

Teaching Experience and Class Size

The majority of participants, at 55.3 percent (n=83), have been teaching between 3 to 15 years. All other participants have either been teaching more than 15 years (32.7 percent, n=49), or less than three years (10.6 percent, n=16). The percentages for each of the ranges are available in Appendix F, Table F5.

Class size reporting indicates that the majority of participants instruct classes that are less than 25 students (36 percent, n=54) or between 25 and 50 students (28 percent, n=42). Only a few reported teaching classes in excess of 51 students (12 percent, n=27). A notable 17 percent (n=26) reported that their class sizes vary indicating they teaching both large and small classes.

Computer Skills and Preference

Questions about self-perceived computer skills and computer preference were asked of the participants. Respondents were asked to rate their computer skills on a 5-point scale (Novice-to-Expert). Almost half (47 percent, n=71) reported themselves as being Above Average, with an additional 14.7 percent (n=22) reporting Expert computer skills. The Average responses made up almost one-third at 34.7 percent (n=52), with only 1.3 percent (n=2) reporting Below Average computer skills. No one reported themselves as having Novice computer skills, although two percent (n=3) of the participants did not provide responses. Of the 148 reporting, nearly two-thirds (60.7 percent, n=91) of the participants preferred Windows OS based computers with approximately one-third (34.7 percent, n=52) opting for Macintosh OS. A very small number of participants at 3.3 percent (n=5) preferred another OS, including Linux.

Instruments

The instrument used in this study consisted of a modified version of Watson's (2007) quantitative survey, *College Teaching Self-Efficacy and the Innovation-Decision Process (SE-*

IDP). Whereas Watson studied many factors of demographics and self-efficacy and the relationship to the 5 stages of the innovation-decision process from Rogers' diffusion model, this study measured very specifically the same self-efficacies and any relationships to the commonly used higher-education diffusion Concerns Based Adoption Model's and its seven Stages of Concern (which measure the affective domain). The revised instrument used for this study consisted of five parts:

1. Demographic questions,
2. Specific questions from Prieto's College Teaching Self-Efficacy Scale (CTSES) (Translation by Frank Pajares),
3. Lichty's Teaching with Technology Self-Efficacy Scale (MUTEBI),
4. Chen's New General Self-Efficacy (NGSE) Scale, and
5. Hall and Hord's Stage of Concerns Questionnaire (SoCQ).

This revised SE-IDP is referred to as the *College Teaching Self-Efficacy and the Stages of Concern (SE-SoC)*. See Appendix C for the SE-SoC used.

Demographic Data

Watson's (2007) demographic questions from his original SE-IDP survey were used to capture facts, demographic data, attitudinal perspectives, and self-perceptions of the target population. (See Appendix C). Watson (2007) states, "These questions were crafted to collect demographic information including sex, age, years of teaching experience, professional rank, class size, highest degree held, discipline, college, self-assessment of computer skills, [and] computer type preference" (p. 108). Watson's demographic questions were useful for this study because they teased out potential biases and provided data for stratification purposes.

Prieto's College Teaching Self-Efficacy Scale (CTSES) (Prieto, 2005, as translated by Pajares, 2006)

In 2005, Leonor Prieto Navarro from the Universidad Pontificia Cornillas developed the College Teaching Self-Efficacy Scale (CTSES) intended for use in higher education. In 2006, she won an award for her development of the instrument. Frank Pajares included an English translation of it on his Emory University comprehensive self-efficacy web site and cites it as a "sound scale that can be trusted" (Pajares, 2006), thus establishing the credibility of Prieto's CTSES scale.

Pajares' translated version of Leonor Prieto Navarro's College Teaching Self-Efficacy Scale (CTSES) was used to collect information about self-perceptions regarding general college teaching. The CTSES consists of 44 questions. (See Appendix C.)

Many researchers also report the measures of reliability and validity of their instruments. Chronbach's alpha is a measure of internal test reliability. It looks at the intercorrelation of the questions asked of a sample population by investigating to what extent the questions measure the same thing. A higher score indicates a higher intercorrelation among the questions. Higher scores indicate that the questions are good, sound, and consistent. Strong scores are equal to or above 0.70 with excellent scores being above 0.90. Prieto reports a reliability alpha coefficient of 0.94 for her CTSES scale and much of the research supporting this instrument confirms this (Prieto, 2005; Wimer, 2006).

Watson's research adjusted Prieto's Likert scale questionnaire to be 0-to-10; he based the change on recent research from Bandura, Hartley and Valiante, and Pajares that indicated longer scales were "psychometrically stronger" given that "people tend to avoid the extremes on scales" (Watson, 2007, p. 108). A larger scale represents a wider range of nuanced responses. Scores

higher on the scale indicate higher self-efficacy. A Chronbach's alpha conducted for this study resulted in a reliability alpha coefficient of 0.97 (n=145).

Lichty's Teaching with Technology Self-Efficacy Scale (MUTEBI) (Lichty, 2000)

Lichty's Teaching with Technology Self-Efficacy Scale (MUTEBI) was used to collect information about self-perceptions regarding teaching with technology. The MUTEBI contains 10 questions. (See Appendix C.)

Riggs and Enochs (1990) first developed their instrument to measure self-efficacy of science teachers. From there, Enochs, Riggs, and Ellis (1993) developed the Microcomputer Utilization in Teaching Efficacy Beliefs Instrument (MUTEBI). The MUTEBI contains two subscales. One of the scales is a teaching with technology self-efficacy scale and consists of ten questions worded in non-discipline specific terms. This non-discipline bias allowed Lichty (2000) to modify it for her use in studying faculty teaching medical courses. Watson (2007) elected to use Lichty's version of the MUTEBI to determine teaching with technology self-efficacy for a variety of reasons. First, it had been used with a variety of populations. Second, it was originally built-upon the respected Gibson and Dembo (1984) scale. Thirdly, it had a high reliability coefficient.

The original Enochs, Riggs, and Ellis MUTEBI self-efficacy scale (which Lichty's MUTEBI is based upon) had a reliability (Chronbach's alpha) coefficient of 0.91 (n=232). Lichty's updated version of the MUTEBI used here reports a Chronbach's alpha coefficient of 0.80 (for which anything over 0.70 is considered strong).

For consistency and congruency with the other scales, Watson (2007) also modified the 0-to-5 point MUTEBI Likert scale to 0-to-10 point scale. This again provides a wide range of nuanced responses, with higher scores indicating higher self-efficacy. A Chronbach's alpha

conducted for this study resulted in a reliability alpha coefficient of 0.93 (n=147) for which scores being above 0.90 indicates strong reliability.

Chen's New General Self-Efficacy (NGSE) Scale (Chen, Gully, & Eden, 2001)

Chen's New General Self-Efficacy Scale (NGSE) was used to collect information about self-perceptions regarding an "individuals' ability to perform across a variety of situations" (Judge, et al., 1998, p. 170). The NGSE contains 8 questions. (See Appendix C.)

There are two types of self-efficacy that are thought to exist: task-dependent and task-independent (general) self-efficacy. The difference between them is task-specific; self-efficacy "is a motivational state and general self-efficacy is a motivational trait" (Chen, Gully, & Eden, 2001, p. 63). It is equally argued that both self-efficacies contribute to motivation and behavior. In his research, Watson included general self-efficacy because he was interested in examining motivation as an underlying psychological factor. For that, he chose Chen's NGSE based upon the recent and positive initial reviews and highest internal consistency to-date.

Chen's NGSE internal consistency (alpha coefficient) falls reliably within the 0.85 to 0.90 range and presents a stronger alpha coefficient compared to other general self-efficacy scales available. Bandura (1986, 1997) thought the measure was too broad and non-specific to be effectively measured, thus making it an unreliable variable. Chen's NGSE scale has been proven to be reliable and able to measure the esoteric "generality" of self-efficacy that a person embodies; his research and those of his colleagues in the field of general self-efficacy consistently show it is a scale that redeems studying general self-efficacy and can be used and trusted.

Watson (2007) modified the Likert scale to be congruent with the others, as a 0-to-10 point scale "following the findings of Pajares, Hartley, and Valiante (2001), the advice of

Bandura (2006), and based upon the argument provided earlier regarding the selection of appropriate response scales for self-efficacy studies," Watson (2007, p. 114). Scores higher on the scale indicate higher self-efficacy. A Chronbach's alpha conducted for this study resulted in a reliability alpha coefficient of 0.96 (ns=143) for which scores being above 0.90 indicates strong reliability.

Stages of Concern (SoC) and Questionnaire (SoCQ) (George, Hall, & Stiegelbauer, 2006)

George, Hall, and Stiegelbauer's (2006) quantitative 35-question SoCQ was used to capture faculty's personal concerns at the differing stages regarding an instructional technology innovation at a Research 1 university.

Overview of SOCQ. The SoCQ was designed and developed by the Research and Development Center for Teacher Education (RDCTE) at the University of Texas in 1974. An updated version by George, Hall, and Stiegelbauer (2006; Hall & Hord, 2001, p. 99) is used here. The Stages of Concern Questionnaire (SoCQ) is one component from Hall, Hord, and George's (Hall & Hord, 2001; George, et al., 2006) Concerns Based Adoption Model. This model "determines what people who are using or thinking about using various [innovations] are concerned about at various times during the adoption process" (George, et al., 2006, p. 79). It is a quick-scoring paper-and-pencil or online questionnaire revealing the adopters' concerns. The developers of the questionnaire first investigated the validity of the SoCQ by examining how scores on the seven SoC scales related to one another and to other variables as other concerns theories suggested.

Reliability/Validity. Since 1975, 27 studies, including US Department of Education projects, have provided results to the SoCQ creators confirming the validity of the Stages of Concern Questionnaire (George, et al., 2006). Internal inter-reliability (validity) was conducted

between the SoCQ and the results from another component of CBAM, Levels of Use interviews. Using the process developed by Cronbach and Meehl (1955), Hall, Hord, and Dossett (1973) used intercorrelation matrices, judgments of concerns based on interview data, and confirmation of expected group differences and changes over time. To determine the instrument's reliability, the authors used "a generalization of Kuder-Richardson Formula 20 for dichotomous items (Cronbach, 1951)" (George, et al., 2006, p. 20). They found higher correlations between questions that measured the same Stage of Concern than with responses for other stages.

During the 1980s, Kolb (1983), Barucky (1984), Jordan-Marsh (1985), and Martin (1989) adopted the SoCQ for their own purposes. They reported on the use of it to "measure concerns about innovations in nonteaching applications and replicated the development process" (George, et al., 2006, p. 21; Hall & Hord, 1987). In doing so, they strengthened the evidence of replicating the SoCQ research through producing a study with results similar to the expected outcomes. Cheung, Hattie, and Davis (2001) attempted to decrease the number of questions within the SoCQ and found that the original 35-question SoCQ remained superior.

Scoring. Over 27 research studies have validated the high internal reliability (Cronbach's alpha coefficients reliabilities) of the SoCQ. When participants completed the SoCQ, the SoCQ Raw Score Rating was converted to percentile scores and then interpreted as described in George, Hall, and Stiegelbauer's (2006) manual. These results were then plotted to a chart to create a profile for individuals consisting of "peaks." These percentile scores on the profile indicate the "peak" concerns of the participant, reflecting which stage (and type) of concern they were in when asked about an adoption. (See Appendix E.)

A CD provided by the authors contains a computer program that can perform these tasks. The researchers noted, "high numbers indicate high concern, low numbers = low concern, and 0

indicates very low concern of completely irrelevant items" (George, et al., 2006, p. 26). From the profiles, the peak scores were selected and used in the data analysis to determine a relationship between the reported self-efficacies and the peak score. These profiles can also be collectively averaged to form a group profile. A group profile provides a "snapshot" of the group's concerns of the innovation adoption underway at that moment in time.

In this study, as with all self-reported surveys, the accuracy of the responses was assumed to be honestly reported. Due to the anonymous nature of the surveys, there was no opportunity to verify the responses, but open-ended questions were included in the instrument to offer some anecdotal insight on the data collected. Other risks to the soundness of the data include asking participants to self-report on experiences that spanned a 12-month time period.

Procedures

Overview

For this study, the innovation undergoing adoption is the Google Applications for Education (Google Apps) initiative at the university institution. Google Applications for Education (Google Apps) is a suite of productivity software targeted at educational institutions that is similar to Microsoft Office. Google Apps consists of:

1. GMail (email),
2. Google Docs / Drive (documents / online storage),
3. Calendar,
4. Sites (web pages), and
5. Contacts (address book).

The Google Apps suite of products is offered as "software as a service" (SaaS), a method of delivering software and storing data in a remote, on-demand server (often called "the cloud").

Updates and changes to the software happen in "sprint" cycles, usually two week intervals, from which updates are "rolled out" automatically with little announcement. Because Google Apps is cloud-based, the data and software are accessible from anywhere an internet connection exists. Users access the software and data using a thin client, often via web browser.

In Fall 2007 the innovation, Google Applications for Education, was being considered for use at the research institution under study. It was suggested that it could eventually replace the aging and taxing homegrown email system. In Spring 2008 adoption of the innovation, Google Apps, started with a very limited test group of IT professionals. After successful initial tests, information about the system was shared with directors in other technology and learning departments. In Spring 2010, a small pilot group of IT and Learning Technologies professionals were invited to test and demonstrate the system. In Spring 2012, the official move from the campus-hosted email to the Google Apps Gmail was announced. That summer, executives at the university acknowledged and gave support to adopting Google Apps campus-wide; they sent email and published notices in the campus news—the Google Apps suite was officially made available to all faculty and students at the institution under study. In November 2012, a mandate to transition from the homegrown email system to the new Google Apps Gmail system was enforced. For many users, this was their first experience with the innovation and possible awareness of Google Apps for Education. Despite the mandated November 2012 move to Gmail, it was speculated that the use of Google Apps as a collective whole remained very much a new and emerging innovation at the institution under study. Indeed, users and non-users vary in their understanding of the technology designed to support this initiative. Despite this and the fact that the innovation had been available since Spring 2012, many users did not transition their email nor become aware of Google Apps until November 2012 when the existing email system was

phased out. At that time, all university accounts were moved to Gmail. Part of the intent of this study was to reveal to what extent Google Apps was an innovation under adoption.

The participants were contacted via their university email addresses. Because the campus' learning management system (LMS) creates a course for every instructor of record within, a list of all actively teaching faculty was extracted and provided by the director of the LMS for this research. That list was combined with a list of faculty emails obtained from the institution's instructional development center to create a comprehensive list of all faculty email addresses. Combining the two lists provided the greatest opportunity to reach all teaching faculty at the institution, including those that may be adjunct or only teaching one or two courses.

The dissertation research study ran for seven weeks from December 2012 to January 2013. During that time, the survey instrument was available online, 24 hours a day for seven days a week. One email invitation to the study was sent to all members of the aforementioned email list. The emails included the consent form as an attachment and a web link to the online survey. Upon clicking the link to the survey, study participants gave consent and were directed to the survey instrument. The anonymous consent form did not record any participant data, but it did record an electronic date and time stamp of the participants' consent upon participation in the survey. To encourage a higher response rate, email reminders of the survey and the impending closing date were sent to all potential participants two weeks before the survey was officially ended.

Data Analysis

For all of the statistical analysis, the SAS JMP 9.0 and 10 software was used. Descriptive statistics were stratified by demographic variables as seen in the results of the initial pilot study (Appendix G) and dissertation research study (Appendix E). To determine how well the sample

population's faculty rank reflects the actual population of the institution, a chi-square goodness of fit test was performed. There were three self-efficacy scales used in the study that measured an individual's responses to: College Teaching (CTSES), Teaching with Technology (MUTEBI), and General Self-efficacy (NGE). The SoCQ was scored and individual and group profiles were plotted as described by George, Hall, and Stiegelbauer (2006). These profiles produced charts that revealed the highest and second highest "peak" concerns of the participants.

As in Watson's (2007) research, the responses for each of the self-efficacy scales were averaged to determine three overall group scores and the standard deviations for both individuals and the group. These averages reflect the three self-efficacy "norms" for the group, whereas the standard deviation explain how much spread there is (how much deviation there is) from the group "norm." George, Hall, and Stiegelbauer's (2006) quantitative SoCQ was used to capture faculty's personal concerns at the differing stages regarding an instructional technology innovation.

Although all 150 participant responses contained data, some participants did not provide answers to some questions. For the College Teaching Self-Efficacy Scale (CTSES), 145 responses had less than four missing values. For the Teaching with Technology Self-Efficacy Scale (MUTEBI), 147 responses had less than one missing value. For the New General Self-Efficacy scale (NGSE), 143 responses had less than one missing value. These provided enough data to create group averages usable for data analysis. The SoCQ resulted in 146 complete and usable entries for data analysis.

Description of Self-Efficacy Scales Responses

There are three self-efficacy scales used in the study that measure an individual's responses to: College Teaching (CTSES), Teaching with Technology (MUTEBI), and General

Self-efficacy (NGE). As previously mentioned, the College Teaching Self-Efficacy Scale (CTSES) consisted of 44 questions. Reponses that had three or less missing values were included in the study. The Teaching with Technology Self-Efficacy Scale (MUTEBI) contained ten questions. Responses that had no more than one missing value were included in the study. The New General Self-Efficacy scale (NGSE) contained eight questions. Responses that had no more than one missing value were included in the study. The summary of responses, overall means, and standard deviations for these scales are in Appendix F, Table F10.

Description of Stages of Concern Questionnaire (SoCQ)

The total number of responses (n=146) consisted of 35 ranked perception questions (ranging from 0 to 6) followed by five qualitative questions used for anecdotal enlightenment. Responses for this scale were scored according to the scoring and instruction manual of George, Hall, and Stiegelbauer (2006). Raw scores were obtained that were translated into percentile scores. These percentile scores indicated the "peak" concerns of the participant, reflecting which stage (and type) of concern they were in when asked about Google Apps adoption. These results were plotted to charts to create profiles for individuals and for the group. The SoCQ researchers noted "high numbers indicate high concern, low numbers = low concern, and 0 indicates very low concern of completely irrelevant items" (George, et al., 2006, p. 26). When the first and second highest Stages of Concern scores were analyzed for interpretation for both studies, the participating faculty represented only 6 of the 7 different Stages of Concern.

The research questions pertaining to the relationship between self-efficacy and the Stages of Concern required identifying a main stage category from the SoC profile. To determine the main stage category from the SoC profile, the peak (highest scoring stage) was used. For illumination regarding other factors for consideration, the second highest peak (second highest

scoring stage) was also examined. This was consistent and acceptable according to George, Hall, and Stiegelbauer (2006).

When conducting statistical analysis that looks for predictors in a relationship between variables, it is known that ordinal or nominal regression works well for prediction. If we take the stance that the user's stage (in the Stages of Concern) is an ordinal (in a progressive order) variable, one can look at non-parametric methods. (Non-parametric methods are used for studying populations that take on a ranked order and may be necessary when data have a ranking but no clear numerical interpretation.) However, it is more appropriate to treat the user's stage as a nominal variable (not in any particular order, like abstract categories) due to the fact that the seven Stages of Concern are not always linear stages of progression. In fact, while the Stages of Concern does have seven specific stages, there is also a categorization of the stages due to the type of concerns the users embody. Figure 7 illustrates the Stages of Concern and the three categorizations they fall into.

The 7-Stages of Concern has three categorical groupings of SELF (stages 0-2), TASK (3), and IMPACT (4-6). These were used to run nominal logistic regression where X = is a continuous measure, Y = is discrete stages/groupings. For each of the three research questions pertaining to self-efficacy and Stages of Concern, the nominal logistic regression was run where:

X = General SE, Y = 3 Categories of the 7 Stages of Concern;

X = Teaching SE, Y = 3 Categories of the 7 Stages of Concern;

X = Teaching with Tech SE, Y = 3 Categories of the 7 Stages of Concern.

IMPACT	6	Refocusing	The individual focuses on exploring ways to reap more universal benefits from the innovation, including the possibility of making major changes to it or replacing it with a more powerful alternative.
	5	Collaboration	The individual focuses on coordinating and cooperating with others regarding use of the innovation.
	4	Consequence	The individual focuses on the innovation's impact on students in his or her immediate sphere of influence. Considerations include the relevance of the innovation for students; the evaluation of student outcomes, including performance and competencies; and the changes needed to improve student outcomes.
TASK	3	Management	The individual focuses on the processes or task of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, and scheduling dominate.
SELF	2	Personal	The individual is uncertain about the demands of the innovation, his or her adequacy to meet those demands, and/or his or her role with the innovation. The individual is analyzing his or her relationship to the reward structure of the organization, determining his or her part in decision making, and considering potential conflicts with existing structures or personal commitment. Concerns also might involve the financial or status implications of the program for the individual and his or her colleagues.
	1	Informational	The individual indicates a general awareness of the innovation and interest in learning more details about it. The individual does not seem to be worried about himself or herself in relation to the innovation. Any interest is in impersonal, substantive aspects of the innovation, such as its general characteristics, effects, and requirements for use.
	0	Unconcerned	The individual indicates little concern about or involvement with the innovation.

Figure 7. The Stages of Concern About an Innovation with Categories. (George, et al., 2006, p.8). [Fair Use]

Pilot Study

Before the dissertation research study was conducted, a pilot study with a very small sample (n=11) and an established innovation at its mid-point was proposed. The purpose of the pilot was to gather information about the process and to collect data for preliminary review of the data analysis procedures. The procedures of the pilot study mimicked the process of the actual study. This information was used by the researcher to correct any confusing aspects of the study such as instructions, the wording of questions, and to collect information about the procedure itself. The data collected were analyzed with the assistance of the institution's statistical research lab.

Follow-up phone conversations with participants resulted in only a few small grammar and typos to correct, although engaging discussion about the purpose and goals of the intended research were very lively. Participants were very inquisitive in trying to learn what their colleagues had to say and what the results of the study would be. They all pledged to participate in the research study should it be approved. For full explanation and results of the pilot study, see Appendix G.

Chapter IV: Results

Overview of Data Collected

An overview of demographic information was covered in Chapter 3. The full breakdown of demographic information is in Appendix F. For the self-efficacy scales, a summary of the data responses, overall means, and standard deviations from the research study are also in Appendix F, Table F10. A summary of Stages of Concern responses and percentages of those in the resulting categories can also be found in Appendix F, Tables F11, F12, and F13. Below are detailed results for each of the research questions.

Research Question One Results

"Which stage of Rogers' *Diffusion of Innovations* curve is the chosen innovation in?" The first research question concerns itself with identifying the stage of the innovation, Google Apps. It calls into question, "How do you know if an innovation is an innovation?" According to Rogers (2003), innovations consist of five elements: the innovation in question, the communication channels involved, a timeline, a social system, and who has adopted it. Many adoption models, such as the CBAM and its corresponding SoCQ can be used to confirm who has adopted the innovation and to what extent that adoption has taken effect, although it is somewhat limited by those reporting. However, estimation can be extrapolated from the results obtained. The SoCQ provides information about the users themselves, revealing not only their concerns, but also what level they are experiencing those concerns (which correlate to their involvement with the innovation). They also provide information about their own self-classification in using the innovation ("novice," "intermediate," "old hand," etc.). Using information from Rogers' *Diffusion of Innovations*, a look at demographic data can provide a clearer picture of who, what, when, and where the innovation has been adopted (or not).

Results from the SoCQ profiles and raw score results indicated that Google Apps as a collective whole remains very much a new and emerging innovation at the institution under study. Of the 146 respondents, only 13.7 percent (n=20) from the sample population consider themselves to be an "old hand" in using Google Apps. Approximately 47.9 percent (n=70) of the participants considered themselves "intermediate" or "novice" users of Google Apps. Twenty-four percent of participants (n=35) consider themselves non-users at the time of the study. (See Table 3.)

Table 3. Respondent Reported User-Type of Innovation (Google Applications).

Type of User	Number	Percent
Non-user	35	24.0
Novice	47	32.2
Intermediate	43	29.5
Old Hand	20	13.7
Past User	0	0.0
No answer	1	0.7

This clearly falls in line with the expected Rogers' S-Curve for the early stages of an innovation adoption (see Figure 2). The innovators and early adopters have already adopted Google Apps while the early majority is currently gathering information, hovering on the cusp of adoption or disregard.

And although the innovation has taken hold among innovators and early adopters, Google Apps *has never been used* by a reported 34.2 percent (n=50) of the participants, although it is possible they have been introduced to the innovation elsewhere or use it for other purposes such as personal email, documentation, etc. (See Table 4.)

Table 4. Respondent Reported Years Using the Innovation (Google Applications).

Years Using Innovation	Number	Percent
Never	50	34.2
1 year	23	15.8
2 years	20	13.7
3 years	13	8.9
4 years	10	6.8
5 or more	29	19.9
No answer	1	0.7

Research Question Two Results

"What is the Stages of Concern profile for instructors in the use of the innovation?" The second research question concerns itself with identifying and creating a Stages of Concern profile for instructors (individually and as a group) for the innovation, Google Apps.

Demographics

Of the 146 participants, 34.2 percent (n=50) have claimed to have never used the innovation, Google Apps, while at the institution. The remaining population at 65.1 percent (n=95) reported to have used it for at least 1 year or more, and less than one percent (n=1) provided no answer (see Table 4). Of the 146 responses, twenty-four percent (n=35) self-classify as non-users, 62.6 percent (n=90) of users consider themselves "Novice" or "Intermediate," and the rest at 13.7 percent (n=20) consider themselves as "Old Hand" or "Past Users" of Google Apps. Only less than one percent (n=1) did not provide an answer. (See Table 3.)

Table 5. Formal Training Which Respondents Attended.

Attended Training	Number	Percent
Yes	6	4.1
No	138	94.5
No answer	2	1.7

This means the majority of users in this sample was actively engaged with or had used Google Apps in some capacity when selected for the study. Of the sample, only 4.1 percent

(n=6) had received formal Google Apps training (see Table 5). A majority of study participants (87.8 percent, n=128) were not simultaneously involved in the adoption of another innovation at the same time (see Table 6). Knowledge of this informs us that the Google Apps adoption concerns are largely tied into the Google Apps adoption itself and not into other, conflicting, impending, or competing innovations.

Table 6. Respondent Reported Involvement in Another Innovation.

Adopting some other innovation at same time as Google Applications?	Number	Percent
Yes	16	11.0
No	128	87.7
No Answer	2	1.4

SoCQ Profiles

The research questions pertaining to the relationship between self-efficacy and the Stages of Concern required identifying a main stage category from the SoC profile. To determine the main stage category from the SoC profile, the peak (highest scoring stage) was used. For illumination regarding other factors for consideration, the second highest peak (second highest scoring stage) was also examined.

To determine the individual and group profiles for the sample population, the Stages of Concern Questionnaire was administered and plotted as described in George, Hall, and Stiegelbauer's (2006) manual. As mentioned before, high numbers indicate high concerns, low numbers indicate low concerns, and zero indicates no concerns or unawareness of the innovation

mentioned. A Stages of Concern profile was created for each participant. From these, the peak scores were selected and used in the data analysis to determine a relationship, if any, between the reported self-efficacies and the peak score. These profiles were also collectively averaged to form a group profile. This group profile provided a "snapshot" of the group's concerns of the innovation adoption underway at that moment in time.

Table 7. Stages of Concern Response Summary as Categories.

Stage of Concern Category	Number	Percent
SELF (Stages 0-2)	139	95.2
TASK (Stage 3)	3	2.1
IMPACT (Stages 4-6)	4	2.7

Upon evaluating the group of participants by the three possible categories of SELF, TASK, and IMPACT, the majority of participants at 95.2 percent (n=139) identified themselves as being concerned about personal (SELF) matters, whereas 2.1 percent (n=3) and 2.7 percent (n=4) had concerns each in the TASK and IMPACT categories, respectively. (See Table 7.) The participants with high SELF concerns were focused on gathering information about Google Apps or were still largely unaware of the innovation. The summary of all individual responses can be found in Appendix F, Table F11.

Because of excessively high peak stages by a majority of users in the SELF category, a cumulative and normalized selection of the data were also prepared for use by following the instructions on page 34 in the George, Hall, and Stiegelbauer's (2006) manual. This selection

consisted of all participants' references to the different stages. This means that every time a participant answered a question in the SoCQ, it corresponded directly to a Stage of Concern.

Table 8. Stages of Concern Response Summary (Cumulative, Normalized).

Stage of Concern	Percent
Stage 0 (SELF)	28.2
Stage 1 (SELF)	19.1
Stage 2 (SELF)	17.4
Stage 3 (TASK)	15.3
Stage 4 (IMPACT)	4.8
Stage 5 (IMPACT)	7.6
Stage 6 (IMPACT)	7.7

This method allows researchers to see how frequently the different stages are mentioned and what percentage they make up overall; this provided a more nuanced examination of all underlying concerns. This is consistent and acceptable with procedures outlined by George, Hall, and Stiegelbauer (2006). See Table 8 for the summary and distribution of the cumulative and normalized spread of concerns.

Individual Profiles. The SoCQ manual explains how to decipher the profiles to better understand what the participants are concerned about regarding Google Apps. From this, interventions can be identified to address participant concerns. Upon reviewing individual

profiles from this study, the concerns (not just primary and secondary peak, but all of them considered collectively) ranged from Stage 0 (Unconcerned) to Stage 6 (Refocusing), although no one peak score was primarily concerned with Stage 4 (Consequences) nor Stage 6 (Refocusing). This means that no participant had high Stage 4 (Consequence) concerns regarding the impact the innovation may have upon students, such as relevance, outcomes, performance, competencies, and skills that students may also need to improve their outcomes. Also, no participant indicated a high Stage 6 (Refocusing) peak, where the individual is trying to maximize the innovation's potential, seeking new ways to use it to garner additional benefits, or begun to look past the innovation to see what changes or replacements are on the horizon.

A majority (87.7 percent, n=128) of the individual profiles produced from this study were representative of non-users of the innovation, Google Apps. For these, the profiles were fairly congruent to the expected typical nonuser SoCQ Profile with their concerns "highest on Stages 0, 1, and 2 and lowest on Stages 4, 5, and 6" (George, et al., 2006, p. 37). These users were usually not fully aware of the innovation and were concerned about other things at the time; however, they may be receptive to learning more about the innovation, but only if their Stage 2 score is lower than their Stage 0 score. A closer look at the secondary concerns shed light on whether the innovation was waxing, waning, or at a standstill. Secondary peak scores and percentiles indicated that Stage 1 (SELF) concerns were present (6.2 percent).

A number of individual profiles were also found in a "W" pattern, indicating there were relatively low concerns in Stage 0 (Unconcerned), but high concerns in Stage 3 (Task), and Stage 5 (Collaboration). The gap between the first two peaks illustrated a situation where personal concerns "could interfere with the desire to learn more about the innovation" (George, et al., 2006, p. 45). The gap between the latter peaks illustrated a desire to work with others to see

what they are doing with the innovation. The middle peak, Stage 3 (TASK) concerns, reflected the participant's acceptance (and concerns about the fact) that they must master using Google Apps. Essentially, the "W" shaped profile demonstrated a common problem for which users understood and accepted that they must use--and to some degree master--the innovation, but they were unclear as to the purpose of the innovation, why they must use it, or how it is being used by others. See Appendix G for select individual profiles of the sample population under study.

Because so many individual profiles are "typical nonusers" in this research study, sometimes it helps to look at the cumulative and normalized results to have a better idea of all of the concerns that may be present (George, Hall, & Stiegelbauer, 2006). A cumulative look at the frequency of reported responses indicate that the majority of participants (28 percent) were still widely unconcerned or unaware of Google Apps (Stage 0), but a fair number of participants also had concerns in Stage 1, 2, and 3 (19.1, 17.4, and 15.3 percent, respectively). See Table 8 for the summary and distribution of the cumulative and normalized spread of concerns.

Group Profile. The group profile provided a snapshot and an overview of the concerns of the group. Some of the high peak scores would be obscured due to the averaging process, but still reflected the general consensus and attitude of the group at that moment in time. An investigation into the top two peaks helped to clarify what the group may be concerned about and aided in identifying possible causes and solutions.

Of particular note when reviewing the group profile from this study is the fact that many individuals illustrated a "typical nonuser" profile which occurs when their concerns are highest on Stages 0, 1, and 2 and lowest on Stages 4, 5, and 6. This indicated the individuals have "little concern about or involvement with the innovation" (George, et al., 2006, p. 8), and "that other things, innovations, or activities are of greater concern than the innovation under consideration

with the SoCQ" (George, et al., 2006, p. 48). However, the number of "old hands" with "tailing up profiles," and "intermediate" users with "W" profiles did have some influence upon the group profile.

For the group profile, these influences could be faintly seen. Stage 1 (Informational), Stage 2 (Personal), and Stage 3 (Management) concerns followed each other closely after a large gap between them and the Stage 0 (Unconcerned) peak. Immediately after a low Stage 4 (Consequence), a "tailing up" can be seen. When an individual profile tails up at the end (Stage 5, 6), it suggests that the individual wants to see what other people are doing and thinks they have ideas that are better than the proposed innovation. This also suggests resistance to adopting the innovation. They may also be aware of competing innovations that may exist. Like the individual profiles, this indicated that the group may be resistant to adopting and using Google Apps for personal and market reasons. See Appendix G for the group profile of the sample population under study.

Research Question Three Results

The third research question concerns the type of self-efficacy and its relationship (if any) to a Stages of Concern profile, "What is the relationship between instructor general self-efficacy and the levels of the Stages of Concern (SoC)?"

To determine a possible predictor relationship between general self-efficacy and a stage from the Stages of Concerns, a nominal logistic regression analysis was used. The group average from the NGSE scale (X) was compared in a whole model test to the three SoC categories SELF, TASK, and IMPACT (Y). A whole model test returned a p-value = 0.9670 which is greater than 0.05. This suggests that general self-efficacy does not have a statistically

significant relationship to a stage for a user. For example, high general self-efficacy does not predict an advanced stage of concern (IMPACT). Table 9 offers a summary of these results.

Table 9. p-Value of General Self-Efficacy on Stages of Concern.

Self-Efficacy Type	p-value	Significance
General (NGSE)	0.9670	> 0.05 = None

Research Question Four Results

The fourth research question poses, "What is the relationship between instructor teaching self-efficacy and the levels of the Stages of Concern (SoC)?"

To determine a possible predictor relationship between teaching self-efficacy and the stage from the Stages of Concern, a nominal logistic regression analysis was used. The group average from the CTSES scale (X) was compared in a whole model test to the three SoC categories SELF, TASK, and IMPACT (Y). A whole model test returned a p-value = 0.6416 which is greater than 0.05. This suggests that teaching self-efficacy does not have a statistically significant relationship to a stage for a user. For example, high teaching self-efficacy does not predict an advanced stage of concern (IMPACT). Table 10 offers a summary of these results.

Table 10. p-Value of College Teaching Self-Efficacy on Stages of Concern.

Self-Efficacy Type	p-value	Significance
College Teaching (CTSES)	0.6416	> 0.05 = None

Research Question Five Results

The fifth research question asks, "What is the relationship between instructor technology self-efficacy and the levels of the Stages of Concern (SoC)?"

Using nominal logistic regression, the predictor relationship between teaching with technology self-efficacy and the Stages of Concern was revealed. The group average from the MUTEBI scale (X) was compared in a whole model test to the three SoC categories SELF, TASK, and IMPACT (Y). In a whole model test, the p-value = 0.0980 which is greater than 0.05. This suggests that teaching with technology self-efficacy does not have a statistically significant relationship to a stage for a user. For example, high teaching with technology self-efficacy does not predict an advanced stage of concern (IMPACT). Table 11 offers a summary of these results.

Table 11. p-Value of Teaching with Technology Self-Efficacy on Stages of Concern.

Self-Efficacy Type	p-value	Significance
Teaching with Technology (MUTEBI)	0.0980	> 0.05 = None

Post-hoc Analysis

The results from the study do not show any statistically strong relationship between self-efficacies and any of the Stages of Concern. Simple graph plots of the three categorical stages versus the self-efficacies illustrate a concentration of Stage 0-2 (SELF) overwhelming the field (see Figure 8), possibly skewing the overall analysis. Explanations for why this may have occurred will be discussed in chapter five.

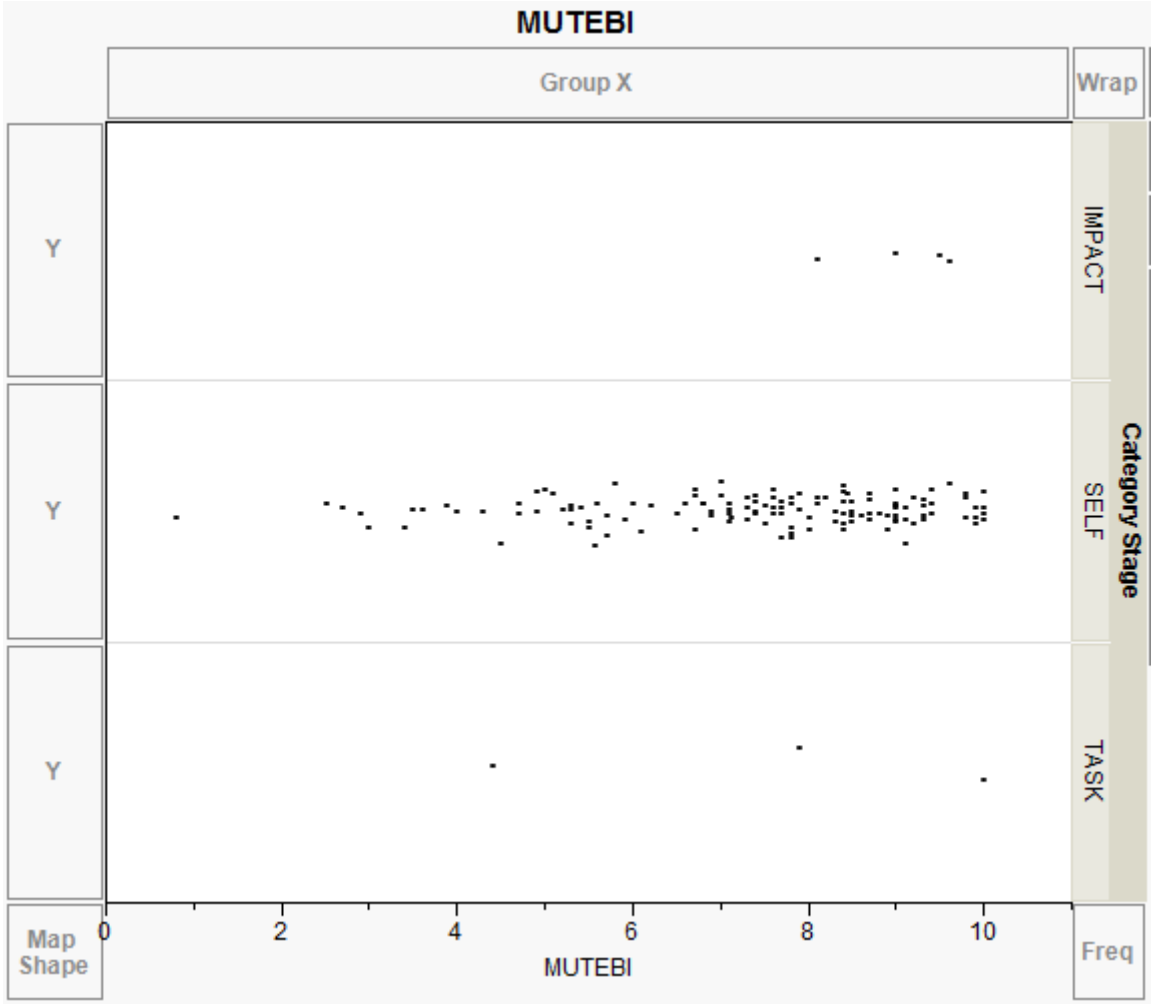

Figure 8. The individual average scores of the Teaching with Technology Self-Efficacy scale (MUTEBI) plotted against the three categories of the Stages of Concern (SELF, TASK, and IMPACT). The overwhelming reports of Stage 0, 1, 2 (SELF) from the concerns profile may skew the overall result.

Chapter V: Discussion

The discussion below includes the purpose of the study, hypothesized expectations, what limitations existed, what the results may mean, and how future studies may wish to proceed.

The purpose of this quantitative study was to explore the relationship between various self-efficacies and different stages of concern resulting from the pedagogical and technological adoption of an innovation, Google Apps, in a large, higher education institution. The Stages of Concern (SoC) refers to the stages of affective domain those users of an innovation experience when faced with the adoption of an innovation. This model ties closely into the field of Diffusion of Innovations (Rogers, 2003) and shares many similarities with the TBCM model from the health and behavioral sciences field in which self-efficacy is often reported as being a strong predictor of stage change readiness (or the readiness to change). Literature from chapter two regarding research surrounding the TBCM by Marcos and Owen (1992), DiClemente, Prochaska, and Gibertini (1985), et al. *implied* that psychological motivational components such as self-efficacy are key to behavioral changes through the stages of successful adoption. Because these self "beliefs about one's perceived capability … to attain designated types of performances and achieve specific results" (Pajares, 1996, p. 546) are fundamental to the success of new behavior adoption, researchers from health disciplines have produced studies suggesting that an adopter's self-efficacy may be the single most effective predictor of behavioral outcomes when adopting new habits.

Watson (2007) found that the innovations-decision stage (a more general innovation-diffusion model than the Stages of Concern) "did vary significantly based upon one's level of teaching with technology self-efficacy. […] those with higher teaching with technology self-efficacy would be farther along in the process of adopting instructional technologies than those

with less teaching with technology self-efficacy" (Watson, 2007, p.143-6). Previous research by Lichty (2000) in the medical field, and DiClemente et al. (1985, 1990) and Marcos et al. (1992a, 1992b, 1994, 1998) in behavioral change (discussed at length in Chapter 2) suggested similar trends of self-efficacy influence in their change models. As Watson (2007) explained:

> The adoption of innovations is a process similar to other forms of behavioral change. Given that the current findings and those from the health-related behavioral change field confirm the relationship between self-efficacy and stages models of behavioral change, it is reasonable to suspect that they would be generalizable to any field, discipline, or context in which behavior change or innovation adoption is being articulated in terms of a stages of change model that has similarity to the models under consideration. (p. 148-9)

For this study, one survey instrument (a questionnaire) was administered. The survey instrument included the collection of demographic data along with data sets for self-efficacy (for general, college teaching, and teaching with technology), and for the Stages of Concern. Findings from the study were based upon the users' self-reports on self-efficacy response scales and the completion and scoring of the CBAM Stages of Concern Questionnaire (SoCQ). The data were analyzed using chi-square goodness-of-fit test to determine how much the sample population represented the actual population at the institution.

Previous research by Marcus and Owen (1992) and others (Marcus, et al., 1992; Marcus, et al., 1998; Marcus & Simkin, 1994) used straight comparisons and ANOVA to determine relationships (although they only *implied* self-efficacy may be a predictor). Watson used additional methods (ANOVA, Pearson-r, and multiple regression) and generally found strong relationships between all the self-efficacies and the stages of Rogers' innovation-decision process, but suggested that teaching with technology self-efficacy was the most influential.

Because of this, it was suspected there would be at least one predictor relationship between the three self-efficacies and a user's stage in the concerns profile. There appeared to be strong support for considering teaching with technology self-efficacy as a predictor of a stage. This appeared to be true for both general innovation-diffusion models (Watson, 2007) and for the similarly aligned (and psychologically-sensitive and nuanced) Stages of Concern profile. Watson's research indicated that general and teaching self-efficacies also share a weak predictor relationship to stages in an innovation-diffusion model. This was based on research results reported in Watson's (2007) dissertation study that also looked for relationships between self-efficacies and a general innovation-diffusion stage model. Given Watson's previous research, there was an expectation that college teaching self-efficacy could also be a predictor (but again not the strongest predictor) of a stage in the Stages of Concern.

However, this is in stark contrast to the results discovered in this research. When the various self-efficacies were examined and tested for a predictor relationship with the Stages of Concern categories, no significant statistical relationship was found. Although there are known limitations of the study which are discussed later in this chapter, it's also possible that diffusion models or previous research analysis methods were not appropriate for the process of predicting relationships. In lieu of using Rogers' general model of adoption, this research study used the nuanced Concerns Based Adoption Model Stages of Concern Questionnaire which resulted in raw scores usable in statistical analysis along with individual and group profiles. These profiles revealed the users to be clearly in corresponding affective-domain adopter categories. And rather than using ANOVA as in previous studies (Marcus, et al., 1992; Marcus, et al., 1998; Marcus & Owen, 1992; Marcus & Simkin, 1994; Watson, 2007), nominal logistic regression was selected for a variety of compelling reasons. The most compelling is that nominal logistic

regression compares an independent variable (X = [general|teaching|technology] self-efficacy) against categorical, dependent variables (Y = SoC Categories) to determine if a predictor relationship existed between any of the three various self-efficacies (college teaching, teaching with technology, and general) and the adopter's SoC categories.

Futhermore, the results may have been influenced by the large number of non-users and early adopters responding to the study. This study identified that nearly 95% of the users of the innovation, Google Apps, were identified as non-users and early-adopters. What Watson (2007) and Marcus (Marcus, et al., 1992; Marcus, et al., 1998; Marcus & Owen, 1992; Marcus & Simkin, 1994) reported from their research was that self-efficacy is low at the early, initial stages of adoption. Based on this information, it would be reasonable to expect that the nearly 95% of the users of Google Apps would have low scores of self-efficacy for any or all three of the self-efficacies measured; however, this is not the case. Average scores (on a scale of 1-10) among the participants as a group for the various self-efficacies are as follows:

Table 12. Self-Efficacy Scales Responses Summary

Self-Efficacy	N	Mean	Std. Deviation
College Teaching	145	7.82	1.24
Teaching with Technology	147	7.39	1.91
New General	143	8.03	1.49

The group averages for all three self-efficacies remain well above the midpoint (5) and possibly suggests that self-efficacy is not as indicative of the stage changes as previously thought.

In all, over 150 individual Stages of Concern profiles were produced. Some of the individual profiles plotted unusually, showing high self-concerns and a secondary, later peak stage, but the majority of those sampled produced profiles that were largely in the "Self" concerns category. This indicates that for these individuals with high Stage 0 or 1 concerns there would be a:

> … general awareness of the innovation and interest in learning more details about it. [They do] not seem to be worried about himself or herself in relation to the innovation. Any interest is impersonal, substantive aspects of the innovation, such as its general characteristics, effects, and requirements for use. (George, et al., 2006, p. 8)

For users like these in the first stages of concern, it is best not to share explicit procedures, steps, or details, but rather broad concepts about what Google Apps is, what features does it provide, how is it better than what they are currently using or doing, and hearing testimony from other users they trust and respect.

Overall, Watson (2007) suggested that teaching with technology self-efficacy would be the most likely to have a relationship with a particular stage, followed by general and possibly teaching self-efficacy. With 150 self-efficacy responses and the resulting profiles created, the nominal logistic regression statistical analysis for this study revealed a statistically insignificant relationship between any of the self-efficacies and stages in the Stages of Concern profiles (as measured by the SoCQ).

Limitations

Several limitations should be considered when interpreting these results and outcomes. First, the SoCQ profiles and results from the questionnaire do indicate that Google Apps is a new innovation in use at the institution. Worth mentioning is that the majority of the population (65

percent, n=95) reports a working knowledge of Google Apps in some capacity when responding to this study, but are not necessarily using the product much at the time the survey was administered. (See Tables 3 and 4.) In fact, an overwhelming majority of participants (95.2 percent, n=139) produced SoC profiles that revealed them as having high self-concerns (SELF Category, Stages 0-2; see Figure 4). For those adopters eliciting self-concerns, they could be unaware or unconcerned about Google Apps, interested and gathering information about what Google Apps is, or exhibiting duress as they wrestle feelings of inadequacy to meet demands and to determine what his or her role is regarding the innovation. (George, et al., 2008). Indeed, if concerns are heightened at the Self-concern levels, those same concerns become blockers for adoption until the concerns are either alleviated or eliminated (Hall & Hord, 1987, 2001). An unmanaged (or poorly managed) innovation often results in a large number of participants "stuck" in the SELF stage. Riggs and Enochs (1990) explained:

> It is critical to note that another person cannot simply manipulate higher level concerns development. Holding and changing concerns is an individual matter. However, timely provision of experiences and resources can assist with concerns arousal and resolution, encouraging the development of higher level concerns. Providing training or other interventions that are not aimed at the appropriate concerns (e.g., attempting to force high level concerns) is an almost certain way to increase the intensity of lower, less desirable stage concerns. Training must target the individual concerns of teachers before moving on to concerns of how others, even their own students, will use the available technology. (Riggs & Enochs, 1990, p. 14)

Second, the sample population is clearly not representative of the larger population. This was likely due to the timing of the release and closure of the survey, effectively conducting the

survey over winter break at the institution. Due to other constraints this was unavoidable for this research, but future attempts should result in a higher response rate if administered at other times during the active semester. The number of returned results of the study came to 150 usable responses representing a possible field of 1,713 actively teaching faculty; only 8.75% of the population responded. Demographic data for the 150 respondents clearly revealed that the sample population is not representative of the larger intended population (see Table 2 and Appendix F, Table F4). In fact, an usually high number (45 percent) of this study's participants were "Non-Tenure Track Faculty" compared to an expected outcome of 19 percent. A few reasons could explain this phenomenon. The survey was released and administered in early December 2012, near the end of the Fall semester and remained open until the first week of the Spring Semester in January 2013. It may be possible that research faculty use their semester breaks to catch up on research, grant, and committee paperwork, as well as scholarly obligations. Perhaps instructional faculty, free of these additional workloads, may be more readily willing and available to participate. Another consideration is that non-tenure track faculty includes instructional, adjunct, and other *occasionally teaching* faculty members. It might be possible they miss out on information, discussions, or training regarding innovations underway. Future researchers may want to consider scheduling the survey collection to be at times that may be more conducive for all faculty participating.

Third, the survey instrument was 123 questions long. Although the pilot test indicated that it only took an average of 13 minutes to complete, it may be worth mentioning that the *perception* of a long questionnaire may have thwarted some faculty from participating. As one faculty member (who did not complete any part of the survey except for the open-ended question) wrote, "This questionnaire must be over 100 questions total, are you crazy?" Efforts to

reduce the size of the SoCQ have been made by other researchers as documented by George, Hall, and Stiegelbauer (2006), but the results are not as exact, nor as beneficial as those produced by the original 35-item survey instrument. The suggestion to find an equally reliable survey for the CTSES (the longest part of the survey with 44 questions) is recommended, although it is a highly regarded scale. Ample tweaking of the visual display of the entire survey instrument may improve initial perceptions. Recommendations for future use of the instrument are to segment the survey into parts so only *n* questions are visible at a time with a progress bar at top. The survey instrument used for this study did not offer those capabilities, although many others (Qualtrix, SurveyMonkey, etc.) now do. Another consideration is that participants were asked to self-report on experiences that spanned a 1-to-12-month time period, depending upon when he or she became aware of the innovation. This means that for some participants, their memory and experience with Google Apps is fresh, whereas for others it may have been quite some time since they last engaged with the innovation. This is always a risk when asking participants to self-report on experiences.

Fourth, as discussed in Chapter 2, this particular study used a psychologically-nuanced innovation-diffusion model in lieu of Rogers' (2003) general Diffusion of Innovations model. Since general and teaching with technology self-efficacy do not appear to correlate to levels within the SoC profile, this suggests that both self-efficacies may not be as reliable a predictor of a user's readiness to change as previously suggested. It may also imply that an issue lies within the selected use of the CBAM Stages of Concern; perhaps it is not as closely aligned to Rogers' Diffusion of Innovations or to the other diffusion models as originally suspected. Given that this is the first experiment involving the selection of a specific model in higher education for

comparison and review against self-efficacies, results may differ should another, but similar to Rogers' diffusion model, higher education model be selected.

Fifth, while it was evident that Google Apps, the innovation under study, is indeed an innovation underway, one limitation may be the fact that several departments and individuals were still largely unaware of Google Apps as a teaching and collaboration tool in addition to its email management capabilities. There may have been some confusion about what was meant by "Google Apps" even though it was explained within Part Five of the survey instrument itself. This is suggested because two participants replied with anecdotal comments such as "I have no idea what you people are talking about," and "You should explain what Google Apps is, and why it has any relation to teaching. I've never heard of it." However, according to George, Hall, and Stiegelbauer (2006), both of these responses are to be expected if non-users who have never been exposed to the innovation are suddenly made aware of it (through the SoCQ itself). This would be especially true if the innovation under study is in the early stages of innovation adoption, much like this one. Because a majority of the reporting participants identified and were scored as non-users and early adopters (in the SELF category), it would be worth investigating to see if innovations at different stages of roll-out (such as mid-point and conclusion) would show any difference in the relationships between self-efficacy and stages of concerns.

Considerations and Recommendations

Many innovations are often technological. Correct or not, oftentimes "technology" is used synonymously with "innovation." Because technology is often a hardware or software product that supports another initiative or innovation, it can sometimes be difficult to understand what exactly the innovation is. Sometimes the "innovation" is the idea, the technology, or they are one and the same. In 2007, Moore, Fowler, and Watson explained how for the past ten years,

colleges routinely attempted change interventions "aimed at integrating technology into teaching and learning activities" (p. 44). As cases like these are common in higher education, it is appropriate to consider the pedagogy and technology weaved together as one. Therefore, "the innovation" under adoption can be defined as both the idea and the technology. This in itself is difficult to manage; combine this with the influences of social groups, interpersonal relationships, decision processes, and common goals. Change agents become responsible for not only the methods to manage the technology and the idea, but also the users, users' perceptions, and users' experiences.

As discussed in the literature, these pedagogical technology innovations are among some of the hardest innovations to successfully implement, track, and adopt. And although many models purport providing methods to successfully roll-out a flawless innovation adoption, only a few truly provide actionable research for doing so. Those models that provide an approach to managing innovations included the higher education model, CBAM, from Hall and Hord (1987, 2001), and the behavioral change model, TBCM, from Prochaska, et al. Both of these models are rooted in the foundations of Rogers (2003) Diffusion of Innovations model. Although the CBAM has not historically been "complemented by methodologies for measuring change processes within each component singly or in combination" (Anderson, 1997, p. 331), it was suggested that by looking deeply into the TBCM's underlying psychological factors involved, a user's *readiness to change* may be discovered. From the literature and previous research studies, the suggested interest in examining self-efficacy became one of the key factors recommended for study. It was theorized that if self-efficacy is related to adoption, it could provide a quick-scoring method for adoption efficiency and effectiveness that would be easy to administer. This was

especially true in the context of higher education where assistive (or ideally, predictive) models for change agents would be especially valuable.

However, this study suggests that no statistically significant relationship exists between any self-efficacies and stages in the Stages of Concern profiles. Although the literature reviewed (Hall & Hord, 1987, 2001; Marcus, et al., 1992; Marcus, et al., 1998; Marcus & Owen, 1992; Marcus & Simkin, 1994; Prochaska & Gibertini, 1985, and Watson, 2007) provided strong support for the role self-efficacy may play in innovation adoption, consider for a moment that perhaps self-efficacy is not the predominant psychological factor in adopting an innovation that it was thought to be. Researchers, including Hall and Hord (1987, 2001) and Watson (2007), have suggested that efforts to identify possible predictors of adopter success lie in "psychological factors … to explore how self-efficacy *and motivation* influence adoption" (*emphasis added*, Watson, 2007, p. 44). Research from the TAM field also suggested that intrinsic motivation should be investigated (Venkatesh & Bala, 2008). If motivation should be investigated, recent research from Reiss (2002, 2012) studied over 6,000 participants and revealed that there are 16 basic intrinsic motivational elements that guide human behavior of which self-efficacy is only one.

In light of the known limitations, the CBAM Stages of Concern model still posits itself as being an ideal model for the study of innovation adoptions in higher education. It is recommended that the known limitations are taken into consideration for future research designs and that other psychological factors ought to be considered, especially when using the Stages of Concerns for analysis of possible predictive relationships.

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Appendix A: IRB Approval

VirginiaTech

Office of Research Compliance
Institutational Review Board
2000 Kraft Drive, Suite 2000 (0497)
Blacksburg, VA 24060
540/231-4606 Fax 540/231-0959
email irb@vt.edu
website http://www.irb.vt.edu

MEMORANDUM

DATE: December 6, 2012

TO: Katherine S Cennamo, Amber Diane Evans

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires May 31, 2014)

PROTOCOL TITLE: Relationship of Self-Efficacy to the Stages of Concern in the Adoption of an Innovation in Higher Education

IRB NUMBER: 12-992

Effective December 5, 2012, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the New Application request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

http://www.irb.vt.edu/pages/responsibilities.htm

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As:	**Expedited, under 45 CFR 46.110 category(ies) 7**
Protocol Approval Date:	**December 5, 2012**
Protocol Expiration Date:	**December 4, 2013**
Continuing Review Due Date*:	**November 20, 2013**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

Invent the Future

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
An equal opportunity, affirmative action institution

Date*	OSP Number	Sponsor	Grant Comparison Conducted?

* Date this proposal number was compared, assessed as not requiring comparison, or comparison information was revised.

If this IRB protocol is to cover any other grant proposals, please contact the IRB office (irbadmin@vt.edu) immediately.

Appendix B: Participant Recruitment Materials

127

Amber D. Marcu <amber.evans@gmail.com>

Participate in a doctoral research study on perceptions and Google Applications for Education

Amber Evans <adevans@vt.edu> Wed, Dec 19, 2012 at 6:46 PM
To: Amber Evans <adevans@vt.edu>

Dear Faculty:

You are invited to participate in a dissertation research study designed to collect data about demographics, your perceptions and opinions regarding your confidence performing a variety of activities / tasks associated with your teaching process, and your perceptions and opinions about Google Applications for Education (Gmail, GDocs, Calendar, Sites, and Contacts). The survey will be open and available for completion until mid-January. In order to participate, you must be at least 18 years old.

The purpose of this research study is two-fold:

I. To investigate the relationship, if any, between select instructor demographics, three types of self-efficacies (general, college teaching, and teaching with technology), and the Concerns-Based Adoption Model's Stages of Concerns;

II. To provide data for analysis and reporting in a doctoral research study and associated content.

If you agree to participate in this research, you will participate in two stages: (a) this initial contact with the attached consent form, and (b) the study (completing the online survey instrument). The submissions are automatically date and time stamped. Estimated time to complete the survey is 10-15 minutes.

Before you give consent to volunteer, it is important that you read the informed consent form, ask as many questions as necessary to be sure that you understand what you are being asked to do. You must complete the entire survey in order for your responses to be counted. All answers are required and some questions may be worded very similarly. Please read each part and question thoroughly before answering and give honest, thoughtful responses. There are no risks for participating in this study.

Please (1) Read the attached consent form, and (2) click on the following link if you wish to participate:
https://survey.vt.edu/survey/entry.jsp?id=1352856578748

Your participation will provide valuable information and data used in the development of a research dissertation and associated content. Your information will be kept strictly confidential and no one other than the researchers will access the data. Any shared, published, or reported data will be stripped of all identifying information. This study has been approved by Virginia Tech's IRB# 12-992. Please refer to the attached informed consent form.

If you have any questions or wish to be removed from future emails, feel free to contact Amber D. Evans-Marcu (adevans@vt.edu or (530) 426-2372).

Thank you for your time and consideration.

Sincerely,

Amber D. Evans-Marcu

Ph.D. Candidate, Instructional Design and Technology, Virginia Tech
adevans@vt.edu | 530-426-2372 | http://www.linkedin.com/in/adevans

Amber D. Marcu <amber.evans@gmail.com>

Participate in a doctoral research study on perceptions and Google Applications for Education

Amber Evans <adevans@vt.edu> Thu, Jan 17, 2013 at 7:10 PM
To: Amber Evans <adevans@vt.edu>

This is a reminder email for your participation. You will not receive any further reminders to this email address. If you have already completed the survey, please disregard this email. Thank you for your time.

Dear Faculty:

You are invited to participate in a dissertation research study designed to collect data about demographics, your perceptions and opinions regarding your confidence performing a variety of activities / tasks associated with your teaching process, and your perceptions and opinions about Google Applications for Education (Gmail, GDocs, Calendar, Sites, and Contacts). The survey will be open and available for completion until mid-January. In order to participate, you must be at least 18 years old.

The purpose of this research study is two-fold:

I. To investigate the relationship, if any, between select instructor demographics, three types of self-efficacies (general, college teaching, and teaching with technology), and the Concerns-Based Adoption Model's Stages of Concerns;

II. To provide data for analysis and reporting in a doctoral research study and associated content.

If you agree to participate in this research, you will participate in two stages: (a) this initial contact with the attached consent form, and (b) the study (completing the online survey instrument). The submissions are automatically date and time stamped. Estimated time to complete the survey is 10-15 minutes.

Before you give consent to volunteer, it is important that you read the informed consent form, ask as many questions as necessary to be sure that you understand what you are being asked to do. You must complete the entire survey in order for your responses to be counted. All answers are required and some questions may be worded very similarly. Please read each part and question thoroughly before answering and give honest, thoughtful responses. There are no risks for participating in this study.

Please (1) Read the attached consent form, and (2) click on the following link if you wish to participate:
https://survey.vt.edu/survey/entry.jsp?id=1352856578748

Your participation will provide valuable information and data used in the development of a research dissertation and associated content. Your information will be kept strictly confidential and no one other than the researchers will access the data. Any shared, published, or reported data will be stripped of all identifying information. This study has been approved by Virginia Tech's IRB# 12-992. Please refer to the attached informed consent form.

If you have any questions or wish to be removed from future emails, feel free to contact Amber D. Evans-Marcu (adevans@vt.edu or (530) 426-2372).

Thank you for your time and consideration.

Sincerely,

Amber D. Evans-Marcu

Informed Consent for Participants in Research Projects Involving Human Subjects

College Teaching and Innovation Adoption Study

Thank you for agreeing to participate in this research study.

This survey includes questions about demographics, your perceptions and opinions regarding your confidence performing a variety of activities / tasks associated with your teaching process, and your perceptions and opinions about Google Applications for Education (Gmail, GDocs, Calendar, Sites, and Contacts). In order to participate, you must be at least 18 years old.

Before you give consent to volunteer, it is important that you read the following information, and ask as many questions as necessary to be sure that you understand what you are being asked to do. You must complete the entire survey in order for your responses to be counted. All answers are required and some questions may be worded very similarly. Please read each part and question thoroughly before answering and give honest, thoughtful responses.

Purpose of the Study:

The purpose of this study is to investigate the relationship between select instructor demographics, three types of self-efficacies (general, college teaching, and teaching with technology), and the Stages of Concerns. Following the research suggestion put forth by Watson's (2007) research, an investigation into the relationships between self-efficacy and stage changes will be examined.

Description of the Study:

This study contains a series of questions that can be answered by simply checking a box. All answers are kept strictly confidential. If you voluntarily provide your VT PID, it will only be used for record-keeping purposes and for follow-up questions should you request to be contacted. You will not be asked to provide any other identifying information. The entire survey should take you about 10-15 minutes to complete.

The target population of this study is teaching and research faculty at Virginia Tech. The data will be stripped of all identifying information when presented in the form of academic conferences, papers, and in the culmination of a doctoral dissertation.

Investigators:

Amber D. Evans-Marcu, doctoral student of the Instructional Design and Technology program at Virginia Tech, is conducting this research project. Other researchers involved are the doctoral committee members: Dr. Katherine Cennamo (Advisor), Dr. Peter Doolittle, Dr. Michael Evans, and Dr. Barbara Lockee.

II. Procedures:

If you agree to participate in this research, you will be directed to a secure online survey. It will take you approximately 10-15 minutes to complete. Once you complete all questions, your response will be automatically collected. There are no other duties required of the participants.

III. Risks or Discomforts:

There are no health risks or discomforts associated with participating in this study. However, you may discontinue participation at any time and it will not affect your relationship with the researcher or the university.

IV. Benefits of the Study:

The benefits of this investigation are three-fold:

1. to contribute results to an area of innovation diffusion in higher education that has not yet been fulfilled;
2. to determine if results from this study are consistent with those found in a sister innovation diffusion discipline, behavioral change; and
3. to possibly suggest which (if any) self-efficacy may be a predictor of adoption categories (and ultimately successful adoption of an innovation).

It is expected that findings from this research study will inform the final reporting of a dissertation research study.

V. Extent of Anonymity and Confidentiality:

You will not be required to provide your VT PID, but you will be asked to voluntarily provide it for record-keeping purposes and for any follow-up questions that you or the researchers may have. Your answers will be and remain strictly confidential. Any shared, published, or reported data will be stripped of all identifying information. All data will be stored online in VT Survey (http://survey.vt.edu/) or on Amber D. Evans-Marcu's personal computer that is password protected. Only the researchers of this study will have access to the data. It is possible that the Virginia Tech Institutional Review Board (IRB) may view this study's collected data for auditing purposes. The IRB is responsible for the oversight of, and the protection of, human subjects involved in research.

VI. Compensation

You will not be compensated for participating in this study.

VII. Freedom to Withdraw

If you agree to participate in this study, you are free to withdraw from the study at any time without penalty. You can change your mind and withdraw your consent at any time. By giving your consent you are not giving up any of your legal rights.

VIII. Subject's Responsibilities

I voluntarily agree to participate in this study. I have the following responsibility: completing the online survey honestly and completely.

IX. Permission Statement

I have read the preceding Consent Form and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent through completing the online survey questionnaire.

Are you a teaching or research faculty member at Virginia Tech? Do you agree to participate in this study and are at least 18 years of age or older?

- Yes: Complete the Survey at https://survey.vt.edu/survey/entry.jsp?id=1352856578748
- No: I do not agree to participate. (Please close or disregard this content.)

Questions about this Study:

Should I have any pertinent questions about this research or its conduct, and research subjects' rights, and whom to contact in the event of a research-related injury to the subject, I may contact Amber D. Evans-Marcu at adevans@vt.edu or (530) 426-2372.

Approved:

IRB #12-992

Chair, Virginia Tech Institutional Review

Board for the Protection of Human Subjects

Office of Research Compliance

2000 Kraft Drive, Suite 2000 (0497)

Blacksburg, VA 24060

Appendix C: College Teaching Self-Efficacy and the Stages of Concern (SE-SoC)

College Teaching and Innovation Adoption Survey

Study Attributes

Thank you for agreeing to participate in this research study. Because this is a research study, your perceptions, thoughts, insights, and feedback are very important. Please answer all questions as thoughtfully and honestly as you can. Completion of this survey should take approximately 10-15 minutes.

Your answers will remain strictly confidential. Any shared, published, or reported data will be stripped of all identifying information. Only the researchers of this study will have access to the data.

Instructions: This survey consists of five parts and will ask you for demographic information, your perceptions and opinions regarding your confidence performing a variety of activities / tasks associated with your teaching process, and about an innovation at Virginia Tech. Each part of this survey has its own set of instructions. **Please read those instructions carefully before beginning each part.**

Thank you for taking the time to provide answers to this survey.

Part One: Demographic Information

Please supply the following information regarding your experiences and background.

Gender:

- ○ Male
- ○ Female

Age:

- ○ 20 to 29
- ○ 30 to 39
- ○ 40 to 49
- ○ 50 to 59
- ○ 60 to 69
- ○ 70 or above

Highest Degree Held:

- ○ Doctorate
- ○ Masters
- ○ Bachelors
- ◉ Other (Please specify): _____

Professional Rank:

- ○ Professor
- ○ Associate Professor
- ○ Assistant Professor
- ○ Instructional Faculty (Full-time, Non-Tenure Track)
- ○ Adjunct Faculty (Part-time, Non-Tenure Track)
- ○ A/P (Administrative/Professional) Faculty
- ○ Doctoral-level Graduate Teaching Assistant (GTA)
- ○ Masters-level Graduate Teaching Assistant (GTA)
- ◉ Other (Please specify): _____

How many years have you taught on the college level?

- ○ 1 year or less
- ○ 1 to 3 years
- ○ 3 to 5 years

- 6 to 10 years
- 11 to 15 years
- 16 to 20 years
- 21 to 25 years
- 26 to 30 years
- 31 or more years

How many students are in the courses you typically teach?

- less than 25 students
- between 25 and 50 students
- 51 to 100 students
- 100 to 200 students
- more than 200 students
- My class sizes vary

In which college do you most often teach?

- Agriculture and Life Sciences
- Architecture and Urban Studies
- Business
- Engineering
- Liberal Arts and Human Sciences
- Natural Resources
- Science
- Veterinary Medicine

Rate your computer skills:

- Expert
- Above Average
- Average

○ Below Average

○ Novice

What type of computer do you prefer?

○ Windows

○ Macintosh

○ Linux

◉ Other (Please specify): _____

Part Two:

Please indicate how confident you are in your ability to accomplish the teaching-related activities/tasks listed below.

As you consider each statement, ask yourself, "*How confident am I in my ability to ...*"

Response Key:

0	1 2 3 4	5	6 7 8 9	10
No Confidence		Confident		Very Confident

Specify the learning goals that I expect my students to attain?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Actively engage my students in the learning activities that I include in my teaching plan/syllabus?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Create a positive classroom climate for learning?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Reflect on my teaching practice with the aim of making appropriate improvements?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Develop different assessment methods for my students based upon the learning goals I want to check?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Evaluate the effectiveness of my own teaching in light of my students' feedback to me?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Promote student participation in my classes?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Use different evaluation methods?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Prepare the teaching materials I will use?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Ensure that my students resolve the difficulties they encounter while learning?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

As you consider each statement, ask yourself, "*How confident am I in my ability to ...*"

Response Key:

0	1 2 3 4	5	6 7 8 9	10
No Confidence		Confident		Very Confident

Promote a positive attitude towards learning in my students?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Adapt my teaching practices in response to my students' evaluations of my teaching?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Evaluate accurately my students' academic capabilities?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Decide on the most appropriate evaluation method for a particular course?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Ensure that my students consider themselves capable of learning the material in my class?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Employ methodical processes that permit me to assess my own teaching?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Give my students feedback about their progress?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Clearly identify my course objectives?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Maintain high academic expectations?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Use information derived from my own self-reflection to improve my teaching?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

As you consider each statement, ask yourself, "*How confident am I in my ability to ...*"

Response Key:

0	1 2 3 4	5	6 7 8 9	10
No Confidence		Confident		Very Confident

Adequately grade my students' exams and assignments?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Adapt to the needs of my students (motivation, interest, prior knowledge, etc.) when planning my courses?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Think of my students as active learners, which is to say knowledge constructors rather than information receivers.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Provide support and encouragement to students who are having difficulty learning?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Update my knowledge of the subject I am teaching?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Provide my students with detailed feedback about their academic progress?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Modify and adapt my syllabus if my students' needs require it?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Permit my students to prepare and/or develop some of the course units?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Calmly handle any problems that may arise in the classroom?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Develop my teaching skills using various means (attending conferences, reading about pedagogy, talking to other professionals, etc.)?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

As you consider each statement, ask yourself, "*How confident am I in my ability to ...*"

Response Key:

0	1 2 3 4	5	6 7 8 9	10
No Confidence		Confident		Very Confident

Gather information about my students' academic progress during the process of an instructional unit prior to the final assessment of that unit?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Encourage my students to ask questions during class?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Make students aware that I have a personal investment in them and in their learning?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Evaluate the degree to which my course objectives have been met?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Design the structure and content of each class?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Let students take initiative for their own learning?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Show my students respect through my actions?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Be flexible in my teaching even if I must alter my plans?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

As you consider each statement, ask yourself, "*How confident am I in my ability to ...*"

Response Key:

0	1 2 3 4	5	6 7 8 9	10
No Confidence		Confident		Very Confident

Make students aware of the relevance of what they are learning?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Master the material that I cover in class?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Promote my students' confidence in themselves?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Make my students feel that their academic success is due to their own efforts?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Spend the time necessary to plan my classes?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Select the appropriate materials for each class?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Part Three:

The following statements refer to attitudes about using computer-based technologies (e.g., Scholar, PowerPoint, Student Response Systems (clickers), ePortfolio, Google Apps, discipline-specific software, etc.) for instructional purposes.

Indicate your level of agreement with each statement by choosing a number from 0 to 10.

Response Key:

0 1 2 3 4 5 6 7 8 9 10

Strongly Disagree Neutral Strongly Agree

I am continually seeking better ways to use the computer in my instruction.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

I use the computer just as effectively as I do other non- technology-based instructional tools and resources.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

I know the steps necessary to use the computer in an instructional setting.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

I am effective in employing computer resources for instruction.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

I understand computer capabilities well enough to be effective in using the computer for instruction.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

I find it easy to explain to students how to use computer applications.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

I am able to answers students' questions related to the computer.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

I have confidence that I have the necessary skills to use the computer for instruction.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

I would invite my peers to evaluate my computer-based instruction.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

I enjoy using computers whenever I can.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Part Four:

The following questions concern your overall level of confidence to perform effectively across different tasks and situations.

Indicate your level of agreement with each statement by choosing a number from 0 to 10.

Response Key:

0 1 2 3 4 5 6 7 8 9 10

Strongly Disagree Neutral Strongly Agree

I will be able to achieve most of the goals that I have set for myself.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

When facing difficult tasks, I am certain that I will accomplish these tasks.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

In general, I think I can obtain outcomes that are important to me.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

I will be able to successfully overcome many challenges.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

I am confident that I can perform effectively on many different tasks.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Compared to other people, I can do most tasks very well.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Even when things are tough, I can perform quite well.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Part Five:

The purpose of this questionnaire is to determine what people who are using or thinking about using various programs are concerned about at various times during the adoption process.

The items were developed from typical responses of school and college teachers who ranged from no knowledge at all about various programs to many years' experience using them. Therefore, **many of the items on this questionnaire may appear to be little relevance or irrelevant to you at this time.** For the completely irrelevant items, please select "0" on the scale. Other items will represent those concerns you do have, in varying degrees of intensity, and should be marked higher on the scale.

For example:

- **This statement is very true of me at this time.**
  0 1 2 3 4 5 6 **(7)**
- **This statement is somewhat true of me now.**
  0 1 2 3 **(4)** 5 6 7
- **This statement is not at all true of me at this time.**
  0 **(1)** 2 3 4 5 6 7

- **This statement seems irrelevant to me.**
  (0) 1 2 3 4 5 6 7

Please respond to the items in terms of **your present concerns, or how you feel about your involvement with the innovation:**

Google Applications for Education, more commonly known as **"Google Apps."**
Google Apps consists of: **Gmail, GDocs, Calendar, Sites, and Contacts**.

We do not hold to any one definition of the innovation so please think of it in terms of your own perception of what it involves. Phrases such as "this approach" and "the new system" all refer to the same innovation, Google Apps. Remember to respond to each item in terms of your present concerns about your involvement or potential involvement with the innovation, Google Apps.

Thank you for taking time to complete this task.

Response Key:

0	1	2	3	4	5	6	7
Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	

I am concerned about students' attitudes toward Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I now know of some other approaches that might work better.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I am more concerned about another innovation.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I am concerned about not having enough time to organize myself each day.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to help other faculty in their use of Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I have a very limited knowledge of Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

Respond to each item in terms of **your present concerns about your involvement or potential involvement with the innovation, Google Apps (includes Gmail, GDocs, Calendar, Sites, and Contacts).**

Response Key:

0	1	2	3	4	5	6	7
Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	

I would like to know the effect of reorganization on my professional status.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I am concerned about conflict between my interests and my responsibilities.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I am concerned about revising my use of Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to develop working relationships with both our faculty and outside faculty using Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I am concerned about how Google Apps affects students.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I am not concerned about Google Apps at this time.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

Respond to each item in terms of **your present concerns about your involvement or potential involvement with the innovation, Google Apps (includes Gmail, GDocs, Calendar, Sites, and Contacts).**

Response Key:

0	1	2	3	4	5	6	7
Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	

I wold like to know who will make the decisions in the new system, Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to discuss the possibility of using Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to know what resources are available if I decide to adopt Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I am concerned about my inability to manage all that Google Apps requires.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to know how my teaching or administration is supposed to change.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to familiarize other departments or persons with the progress of using Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

Respond to each item in terms of **your present concerns about your involvement or potential involvement with the innovation, Google Apps (includes Gmail, GDocs, Calendar, Sites, and Contacts).**

Response Key:

0	1	2	3	4	5	6	7
Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	

I am concerned about evaluating my impact on students.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to revise the Google Apps approach.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I am preoccupied with things other than Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to modify our use of Google Apps based on the experiences of our students.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I spend little time thinking about Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to excite my students about their part in using Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

Respond to each item in terms of **your present concerns about your involvement or potential involvement with the innovation, Google Apps (includes Gmail, GDocs, Calendar, Sites, and Contacts).**

Response Key:

0	1	2	3	4	5	6	7
Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	

I am concerned about time spent working with nonacademic problems related to Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to know what the use of Google Apps will require in the immediate future.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to coordinate my efforts with others to maximize Google Apps' effects.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to have more information on time and energy commitments required by Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to know what other faculty are doing in this area.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

Currently, other priorities prevent me from focusing my attention on Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

Respond to each item in terms of **your present concerns about your involvement or potential involvement with the innovation, Google Apps (includes Gmail, GDocs, Calendar, Sites, and Contacts).**

Response Key:

0	1	2	3	4	5	6	7
Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	

I would like to determine how to supplement, enhance, or replace Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to use feedback from students to change the program.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to know how my role will change when I am using Google Apps.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

Coordination of tasks and people is taking too much of my time.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

I would like to know how Google Apps is better than what we have now.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

How long have you been involved with Google Apps, not counting this year?

○ Never

○ 1 year

○ 2 years

○ 3 years

○ 4 years

○ 5 or more

In your use of Google Apps, do you consider yourself to be a:

- ○ non-user
- ○ novice
- ○ intermediate
- ○ old hand
- ○ past user

Have you received formal training regarding Google Apps through workshops or courses?

- ○ Yes
- ○ No

Are you currently in the first or second year of use of some major innovation or program other than Google Apps?

- ○ Yes
- ○ No

If yes, describe briefly:

Contact (Optional)

Providing your VT PID will allow the researchers to contact you to answer any questions that you may have about this study or about the innovation, Google Apps (includes Gmail, GDocs, Calendar, Sites, and Contacts), under study.

What is your VT PID? (Optional)

If you provided your VT PID, do you wish to be contacted about this survey

or regarding the innovation, Google Apps (includes Gmail, GDocs, Calendar, Sites, and Contacts)?

- ○ Yes
- ○ No

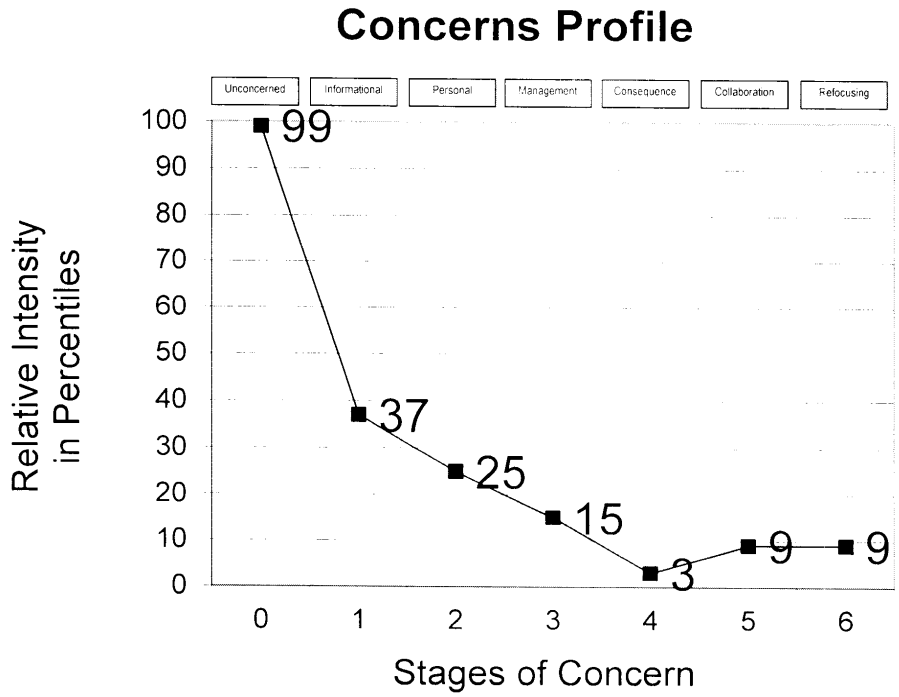
Thank you for your help!

Appendix D: Sample of Stages of Concern Individual Profiles

SoCQ-075

Relationship of Self-Efficacy to Stages of Concern in the Adoption of Innovation in Higher Education

SoCQ Survey Regarding the adoption of Google Applications for Education



26 - Participant ID

old hand - Level

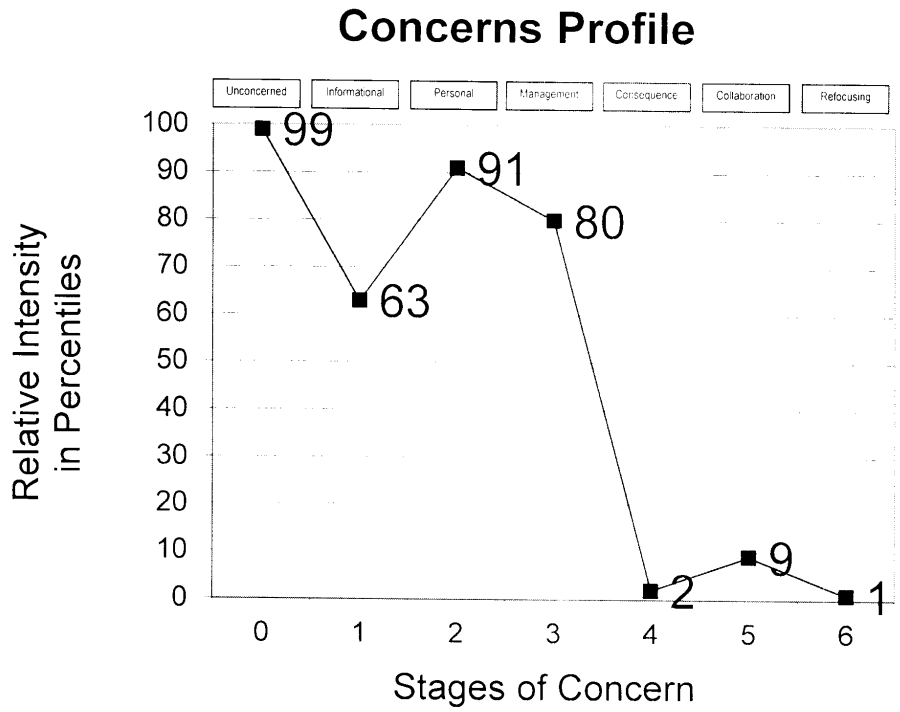
Fall 2012 - Spring 2013 - Semester and year the SoC questionnaire was administered

Research on the Improvement Process / Concerns Based Adoption Model (CBAM)

ScCQ-075

Relationship of Self-Efficacy to Stages of Concern in the Adoption of Innovation in Higher Education

SoCQ Survey Regarding the adoption of Google Applications for Education



37 - Participant ID

non-user - Level

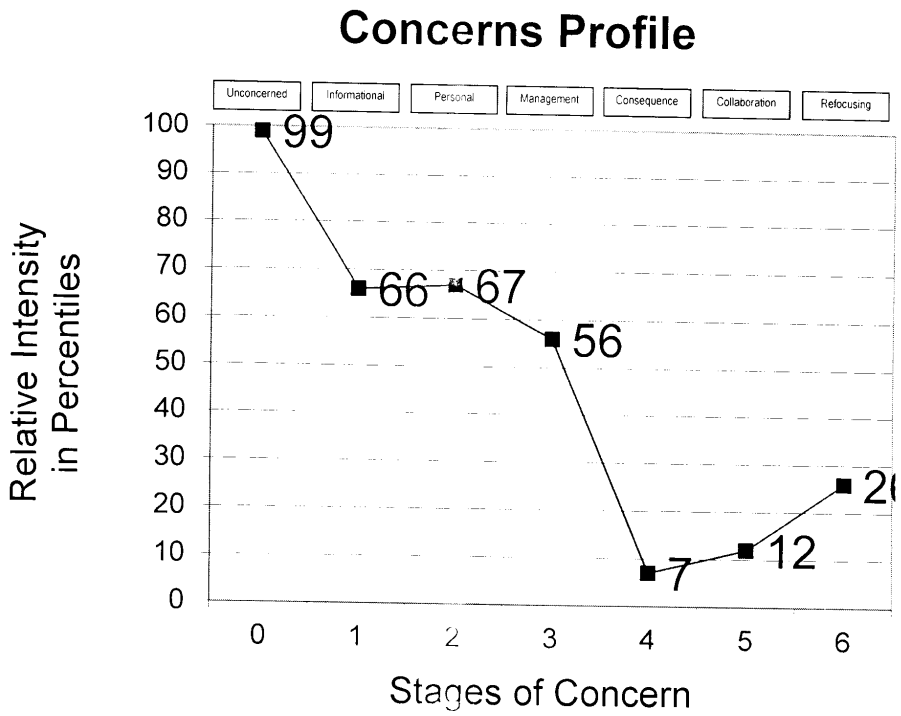
Fall 2012 - Spring 2013 - Semester and year the SoC questionnaire was administered

Research on the Improvement Process / Concerns Based Adoption Model (CBAM)

SoCQ-075

Relationship of Self-Efficacy to Stages of Concern in the Adoption of Innovation in Higher Education

SoCQ Survey Regarding the adoption of Google Applications for Education



58 - Participant ID

novice - Level

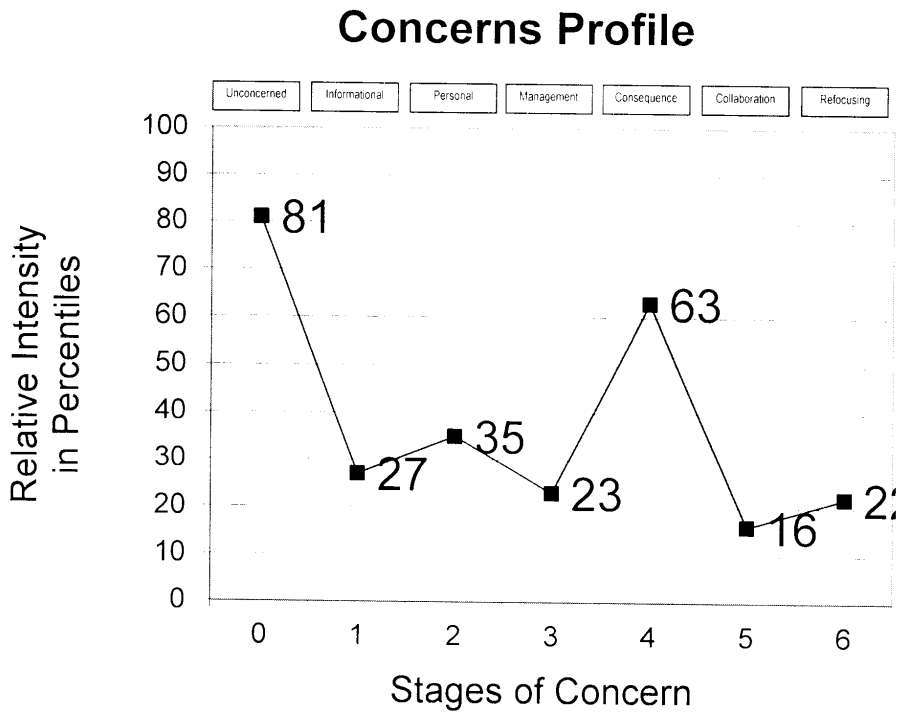
Fall 2012 - Spring 2013 - Semester and year the SoC questionnaire was administered

Research on the Improvement Process / Concerns Based Adoption Model (CBAM)

SoCQ-075

Relationship of Self-Efficacy to Stages of Concern in the Adoption of Innovation in Higher Education

SoCQ Survey Regarding the adoption of Google Applications for Education



62 - Participant ID

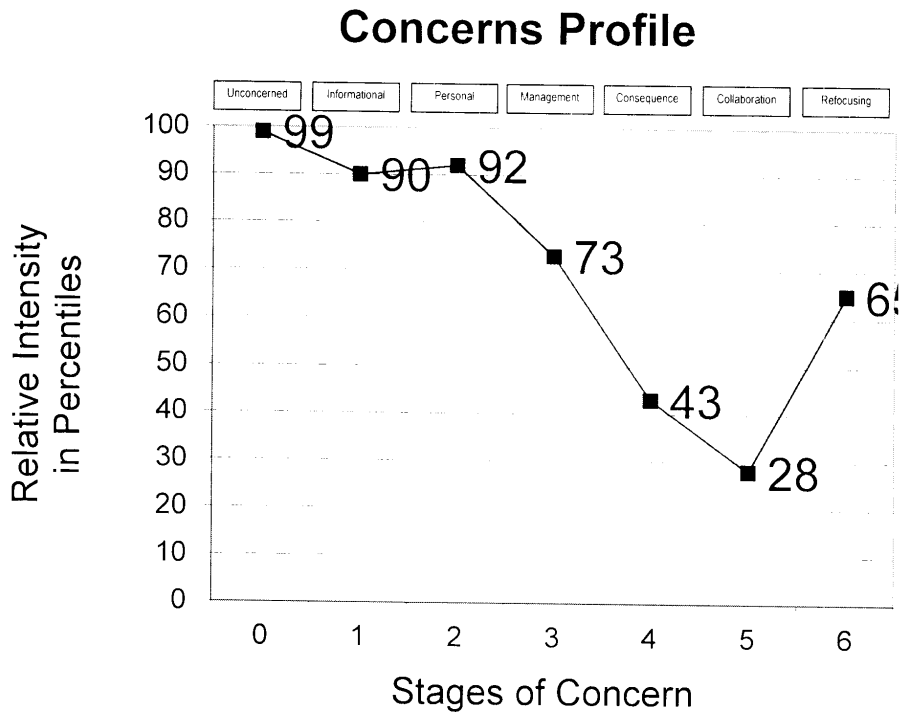
old hand - Level

Fall 2012 - Spring 2013 - Semester and year the SoC questionnaire was administered

Research on the Improvement Process / Concerns Based Adoption Model (CBAM)

Relationship of Self-Efficacy to Stages of Concern in the Adoption of Innovation in Higher Education

SoCQ Survey Regarding the adoption of Google Applications for Education



66 - Participant ID

intermediate - Level

Fall 2012 - Spring 2013 - Semester and year the SoC questionnaire was administered

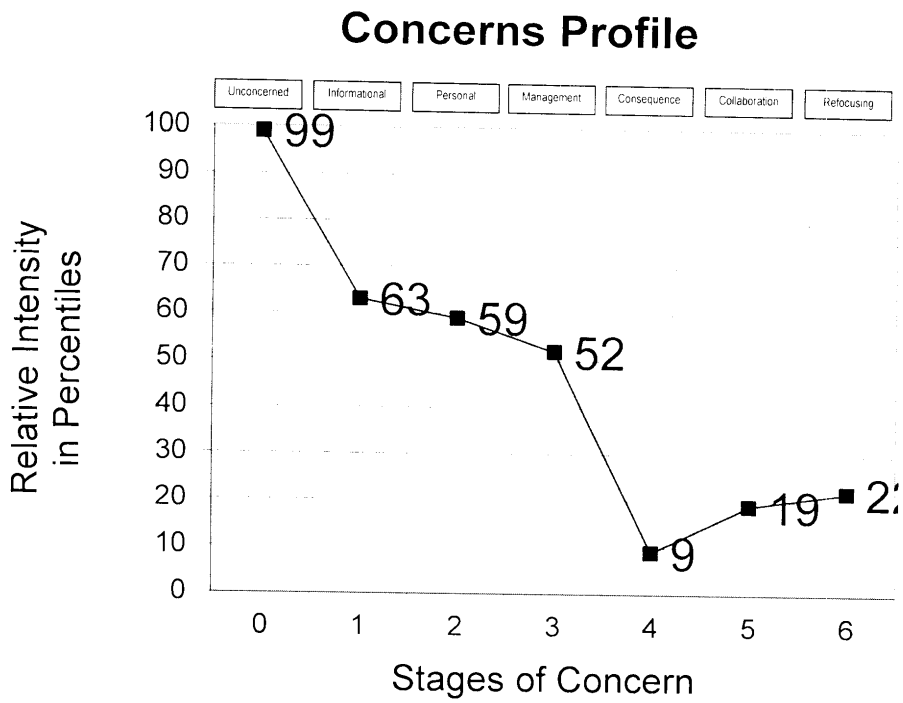
Research on the Improvement Process / Concerns Based Adoption Model (CBAM)

Appendix E: Stages of Concern Group Profile

SoCQ-075

Relationship of Self-Efficacy to Stage of Concerns in the Adoption of Innovation in Higher Education

SoCQ Survey Regarding the adoption of Google Applications for Education



Group Profile - Participant ID

All - Level

Fall 2012 - Spring 2013 - Semester and year the SoC questionnaire was administered

Research on the Improvement Process / Concerns Based Adoption Model (CBAM)

Appendix F: A Breakdown of Summaries from Results of the SE-SoC Survey Instrument.

Table F1

Summary of Responses by Question Area

Question Topic	N	Missing Values
	Respondents (N = 150)	
Gender	146	4
Age	149	1
Highest Degree Held	147	3
Faculty Rank	148	2
Years of Teaching Experience	148	2
Class Size	149	1
College	144	6
Self-Rating of Computer Skills	147	3
Computer Platform Preference	148	2
Teaching Self-Efficacy (CTSES)	145	5
Teaching with Technology Self-Efficacy (MUTEBI)	147	3
General Self-Efficacy (NGSE)	143	7
Stages of Concern Questionnaire (SoCQ)	146	4

Table F2

Respondent Reported Age

Age Range	Number	Percent
20 to 29	5	3.3
30 to 39	37	24.7
40 to 49	41	27.3
50 to 59	49	32.7
60 to 69	14	9.3
70 or above	3	2.0
No Answer	1	0.7

Table F3

Respondent Reported Highest Degree Held

Degree	Number	Percent
Doctorate	110	73.3
Masters	30	20.0
Bachelors	3	2.0
Other	4	2.7
No Answer	3	2.0

Table F4

Respondent Reported Professional Rank

Rank	Number	Percent
Full Professor	22	14.7
Associate Professor	38	25.3
Assistant Professor	21	14.0
Instructional, Full-Time, Non-Tenure Track	19	12.7
Administrative / Professional (A/P)	19	10.7
Adjunct, Part-Time, Non-Tenure Track	16	12.7
Other	13	9.1
No Answer	2	1.3

Table F5

Respondent Reported Years of Teaching Experience

Experience	Number	Percent
1 year or less	8	5.3
1 to 3 years	8	5.3
3 to 5 years	22	14.7
6 to 10 years	37	24.7
11 to 15 years	24	16.0
16 to 20 years	11	7.3
21 to 25 years	15	10.0
26 to 30 years	11	7.3
31 or more years	12	8.0
No Answer	2	1.3

Table F6

Class Size Which Respondents Most Often Teach

Class Size	Number	Percent
less than 25 students	54	36.0
between 25 and 50 students	42	28.0
51 to 100 students	18	12.0
100 to 200 students	5	3.3
more than 200 students	4	2.7
My class sizes vary	26	17.3
No Answer	1	0.7

Table F7

College in Which Respondents Most Often Teach

College	Number	Percent
Agriculture and Life Sciences	18	12.0
Architecture and Urban Studies	8	5.3
Business	10	6.7
Engineering	25	16.7
Liberal Arts and Human Sciences	52	34.7
Natural Resources	8	5.3
Science	16	10.7
Veterinary Medicine	7	4.7
No Answer	6	4.0

Table F8

Respondent Reported Computer Skills

Skill Level	Number	Percent
Expert	22	14.7
Above Average	71	47.3
Average	52	34.7
Below Average	2	1.3
Novice	0	0.0
No Answer	3	2.0

Table F9

Computer Preference Responses

Computer Type	Number	Percent
Windows	91	60.7
Macintosh	52	34.7
Linux	2	1.3
Other	3	2.0
No Answer	2	1.3

Table F10

Self-Efficacy Scales Responses Summary

Self-Efficacy	N	Mean	Std. Deviation
College Teaching	145	7.82	1.24
Teaching with Technology	147	7.39	1.91
New General	143	8.03	1.49

Table F11

Stages of Concern Response Summary

Stage of Concern	Number	Percent
Stage 0 (SELF)	128	87.7
Stage 1 (SELF)	9	6.2
Stage 2 (SELF)	2	1.4
Stage 3 (TASK)	3	2.1
Stage 4 (IMPACT)	0	0.0
Stage 5 (IMPACT)	4	2.7
Stage 6 (IMPACT)	0	0.0

Table F12

Stages of Concern Response Summary as Categories

Stage of Concern Category	Number	Percent
SELF (Stages 0-2)	139	95.2
TASK (Stage 3)	3	2.1
IMPACT (Stages 4-6)	4	2.7

Table F13

Stages of Concern Response Summary (Cumulative, Normalized)

Stage of Concern	Percent
Stage 0 (SELF)	28.2
Stage 1 (SELF)	19.1
Stage 2 (SELF)	17.4
Stage 3 (TASK)	15.3
Stage 4 (IMPACT)	4.8
Stage 5 (IMPACT)	7.6
Stage 6 (IMPACT)	7.7

Table F14

Respondent Reported Years Using the Innovation (Google Applications)

Years Using Innovation	Number	Percent
Never	50	34.2
1 year	23	15.8
2 years	20	13.7
3 years	13	8.9
4 years	10	6.8
5 or more	29	19.9
No answer	1	0.7

Table F15

Respondent Reported User-Type of Innovation (Google Applications)

Type of User	Number	Percent
Non-user	35	24.0
Novice	47	32.2
Intermediate	43	29.5
Old Hand	20	13.7
Past User	0	0.0
No answer	1	0.7

Table F16

Formal Training Which Respondents Attended

Attended Training	Number	Percent
Yes	6	4.1
No	138	94.5
No answer	2	1.7

Table F17

Respondent Reported Involvement in Another Innovation

Adopting some other innovation at same time as Google Applications?	Number	Percent
Yes	16	11.0
No	128	87.7
No Answer	2	1.4

Appendix G: Results of Pilot Study

In February 2011, ePortfolio was identified as an innovation suitable for this pilot study. In October 2011, a total of 11 actively teaching members from the target population regarding the innovation, ePortfolio, participated in the pilot study. Information for the design and execution of the pilot study was based upon the review of other, similar research studies (D'Silva & Reeder, 2005; Malikowski, Thompson, & Theis, 2006; Medlin, 2001; Watson, 2007).

The purpose of the pilot was to gather information about the process and to collect preliminary data. All of the preliminary data collected from the 11 participants can be found in the tables of Appendix D. The pilot study was conducted online from October 2011 to February 2012, but each of the participants completed it within four weeks from first notification to final discussion. The pilot procedure consisted of three stages: (a) the study, (b) feedback on the informed consent form and survey instrument, and (c) an informal, facilitated one-on-one phone or email dialogue. Each pilot participant was sent the invitation letter via email (see Appendix B). Participants were asked to check their email and follow the directions, including submitting the online informed consent form. At that time, pilot participants began completing the online instrument and were asked to record the time of day. After completing the instrument, they recorded the time again and submitted the survey online. The submissions were automatically date-and-time stamped, and the time reported by the pilot participants was used to determine the amount of time needed to complete the survey. Watson's previous use of the SE-IDP indicated a time estimate of 10 to 15 minutes and this revised instrument was consistent, taking an average of 13 minutes to complete.

Upon completion of the first phase of the pilot, participants were then directed to an online copy of the informed consent form and instrument. Pilot participants were asked to make

notes of their suggestions and feedback regarding places where there was confusion. All forms of feedback (typographical, grammatical, etc.) were encouraged. After noting valuable feedback, the third stage began. Follow-up phone interviews or email discussions were conducted at a mutually convenient time. An open-ended one-on-one dialogue between the researcher and the pilot participant enabled the participant to talk freely about the goals of the research and to comment directly on the methods used. It also allowed the researcher to ask for clarification by the participants.

All participants agreed that the consent form was fine. Participants estimated that it took them less than 2 minutes to read the online informed consent form. The entire survey instrument took an average of 13 minutes to complete (the quickest participant finishing in 9 minutes and the slowest participant finishing in 26 minutes). When asked via email, "Do you have any feedback regarding the survey instrument? Were there areas that were confusing or unclear?" responses ranged from "none", to irrelevant (two participants used the opportunity to ask about something non-related to the study), and only one participant responded with:

> Part five made no sense to me, about 'various' concerns at 'various times' - Scholar [ePortfolio] has been in place for ages now and is not 'new' or threatening to me.... Since I have worked with Scholar [ePortfolio] for 4 years now, I think I might have skewed your data....

This is an acceptable and expected response from a longtime user of an innovation. According to George, Hall, and Stiegelbauer (2006), when a "person is so knowledgeable about the innovation there is nothing else for him to learn" (p. 47) he will feel as though the questions in the SoCQ are pointless for he has already mastered the innovation. All other responses from participants were returned indicating that everything in the survey instrument seemed fine as it

was. During this review, the researcher caught the omission of a question from the NGSE scale and added it in.

Phone conversations with participants resulted in only a few small grammar and typos to correct, although engaging discussion about the purpose and goals of the intended research were very lively. Participants were very inquisitive in trying to learn what their colleagues had to say and what the results of the study would be. They all pledged to participate in the research study should it be approved. For results of the pilot study, see Appendix G.

Preliminary Data Analysis

Although not the primary focus of this pilot study, analysis of the pilot study data was useful in determining if the process and procedures for analyzing the data was correct. It also provided some interesting initial data and brought awareness of concerns as discussed during consultations with the institution's statistical assistance program. In conducting this early data analysis, nothing indicated any problems or issues and the researcher's statistical assistance program at the research institution was able to confirm this.

Key elements of data are reported below. The full breakdown of the demographic information is in Appendix D. A summary of the preliminary data responses, overall means, and standard deviations from the pilot study are in Table D10. A summary of Stages of Concern responses and percentages of those in the resulting categories can be found in Table D11 and Table D12.

Overview. No questions were left unanswered. Eleven participants from four college departments ranging in age from 20-to-69 years old participated in this pilot study. Of those, ten were female and one was male. Five participants held Master degrees and six held Doctorate degrees. Regarding computer skills, all but two rated themselves as "Above Average."

Sex and Age. Over 90 percent of the respondents were female. Men comprised roughly 9 percent of the responses. There were six options available for selection regarding age ranges and the distribution of ages fell mostly between 30-39 and 50 to 59.

Degree and Rank. Out of the 11 respondents, 54 percent hold a doctoral degree and approximately 46 percent hold a masters degree. No other degrees were listed. Regarding rank, over 45.5 percent of the responding participants hold the rank of Professor (18.2 percent) or Associate Professor (27.3 percent). The second highest response rate came from doctorate-level GTAs (27.3 percent). A smaller response rate came from Academic Professional faculty (9.1 percent); instructional, non-tenure track (9.1 percent); and other faculty (9.1 percent). The complete list of respondent's professional rank can be found in Table D4.

Goodness of Fit. All participants provided their faculty rank. A chi-square goodness of fit test for rank was applied to the participants' responses. This revealed the level of representation of the larger teaching population. The Office of Institutional Research and Effectiveness provides demographics and statistics for the institution (see Table 3). This includes information about the sub-population of full-time teaching instructors, GTAs, and professors. This data was used to anticipate an expected number of responses from the various groups. The data in Table 3 shows the expected and observed responses for this teaching sub-population.

The null-hypothesis is that the pilot study sample population is the same as the larger desired sample population. The p-value is 0.1026 which is greater than .05 which fails to reject the null hypotheses. Alternatively, one can look at the resulting chi-square value which is 7.715 with four degrees of freedom. The critical value at the 0.05 level with df = 4 is 9.488. Since the calculated chi-square value of 7.715 is less than 9.488, it can be concluded that this sub-

population of respondents is representative of the larger population of professors, instructors, and GTAs at this institution.

Appendix H: Permission to Use Watson's (2007) Survey Questions

Gmail by Google

Amber D. Marcu <amber.evans@gmail.com>

Permission/Notification of my use of your dissertation survey instrument.

C. Edward Watson <edwatson@uga.edu> Tue, Feb 12, 2013 at 8:09 PM
To: "Amber D.Evans-Marcu" <adevans@vt.edu>

Hi Amber,

Congratulations on your continued progress toward the completion of your dissertation. You are certainly more than welcome to use my survey in your research; however, please note the genesis of some portions of it reside with researchers other than myself. My dissertation describes those lineages in detail.

I look forward to reading the results of your study. Keep in touch.

Eddie
[Quoted text hidden]

C. Edward Watson, Ph.D.
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Co-Executive Editor
International Journal of ePortfolio (IJeP)
http://www.theijep.com/

Executive Editor
International Journal of Teaching and Learning in Higher Education (IJTLHE)
http://www.isetl.org/ijtlhe/

Appendix I: Fair Use Analyses

Draft 09/01/2009

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: gailmac@vt.edu)

(Please ensure that Javascript is enabled on your browser before using this tool.)

Virginia Tech ETD Fair Use Analysis Results

This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.

Name: Amber Diane Marcu

Description of item under review for fair use: Rogers, E. M. (2003). Diffusion of Innovations (5th ed.), p. 113 & 281. New York, NY: Free Press.

Report generated on: 04-15-2013 at : 11:58:57

Based on the information you provided:

Factor 1

Your consideration of the purpose and character of your use of the copyright work weighs: ***in favor of fair use***

Factor 2

Your consideration of the nature of the copyrighted work you used weighs: ***in favor of fair use***

Factor 3

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: ***in favor of fair use***

Factor 4

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: ***against fair use***

Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use*

Draft 09/01/2009

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: gailmac@vt.edu)

(Please ensure that Javascript is enabled on your browser before using this tool.)

Virginia Tech ETD Fair Use Analysis Results

This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.

Name: Amber Diane Marcu

Description of item under review for fair use: Moore, G. A. (1999). Crossing the Chasm: Marketing and selling disruptive products to mainstream customers. New York, NY: HarperCollins.

Report generated on: 04-15-2013 at : 11:21:08

Based on the information you provided:

Factor 1

Your consideration of the purpose and character of your use of the copyright work weighs: ***in favor of fair use***

Factor 2

Your consideration of the nature of the copyrighted work you used weighs: ***in favor of fair use***

Factor 3

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: ***in favor of fair use***

Factor 4

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: ***against fair use***

Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use*

Draft 09/01/2009

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: gailmac@vt.edu)

(Please ensure that Javascript is enabled on your browser before using this tool.)

Virginia Tech ETD Fair Use Analysis Results

This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.

Name: Amber Diane Marcu

Description of item under review for fair use: George, A. A., Hall, G. E., & Stiegelbauer, S. M. (2006). Measuring implementation in schools: The stages of concern questionnaire (2nd ed. Vol. 1, p.8). Austin, TX: SEDL.

Report generated on: 04-15-2013 at : 11:18:43

Based on the information you provided:

Factor 1

Your consideration of the purpose and character of your use of the copyright work weighs: ***in favor of fair use***

Factor 2

Your consideration of the nature of the copyrighted work you used weighs: ***in favor of fair use***

Factor 3

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: ***in favor of fair use***

Factor 4

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: ***against fair use***

Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use*