

---

Electronic Theses and Dissertations, 2004-2019

---

2008

## Perspectives Of Health Information Management Faculty Use Of An E-learning Laboratory And Technology Acceptance

Peggy Meli  
*University of Central Florida*

 Part of the [Education Commons](#)

Find similar works at: <https://stars.library.ucf.edu/etd>

University of Central Florida Libraries <http://library.ucf.edu>

This Doctoral Dissertation (Open Access) is brought to you for free and open access by STARS. It has been accepted for inclusion in Electronic Theses and Dissertations, 2004-2019 by an authorized administrator of STARS. For more information, please contact [STARS@ucf.edu](mailto:STARS@ucf.edu).

---

### STARS Citation

Meli, Peggy, "Perspectives Of Health Information Management Faculty Use Of An E-learning Laboratory And Technology Acceptance" (2008). *Electronic Theses and Dissertations, 2004-2019*. 3557.  
<https://stars.library.ucf.edu/etd/3557>

PERSPECTIVES OF HEALTH INFORMATION MANAGEMENT FACULTY USE  
OF AN E-LEARNING LABORATORY AND TECHNOLOGY ACCEPTANCE

by

PEGGY L. MELI

B.S. University of Central Florida, 1980

M.S. University of Central Florida 1995

A dissertation submitted in partial fulfillment of the requirements  
for the degree of Doctor of Philosophy  
in the department of Educational Research, Technology and Leadership  
in the College of Education  
at the University of Central Florida  
Orlando, Florida

Spring Term  
2008

Major Professor: Stephen A. Sivo

© 2008 Peggy L. Meli

## **ABSTRACT**

“As the delivery of healthcare has become more sophisticated, scientific, and complex, the need for HIM (Health Information Management) professionals at all levels has increased, and the role and status of those managing these functions has increased accordingly.” (AHIMA, September 24, 2007). Studies by the Institute of Medicine and others have found suboptimal technology use throughout the healthcare industry. The American Health Information Management Association (AHIMA) developed the e-HIM® Virtual Lab (V-lab) to train students in the use of new technology applications in response to IOM findings. Faculty are the gatekeepers for use of instructional technology in educational settings. Many disciplines have evaluated instructional technology use by students. There are very few studies on faculty use of instructional technology. There are no published studies of the determinant factors influencing health information management (HIM) faculty use of instructional technology. Therefore, the purpose of this study is to evaluate the faculty’s attitude and behavior toward the use of the V-lab instructional technology.

A non-random one group pretest posttest design was used to test the hypothetical Instructional Perception -Technology Acceptance Model (IP- TAM) for faculty perceptions regarding system functionality, usability and technology acceptance. The Path Analysis determined the strongest construct indicators for intent to use the V-lab were Perceived Usefulness (PU), Perceived Ease Of Use (PEOU), System Functionality and Usability (SFU). These findings support the recommendation for a collaborative examination of the existing V-lab systems to improve utilization and success.

To my loving husband, Rod for his enduring and support and in memory of my aunt,  
Margaret E. Taylor, who inspired my career in Health Information Management.

## ACKNOWLEDGMENTS

I would like to express my heartfelt appreciation to those wonderful people who played important roles in the completion of this dissertation. To Dr. Stephen A. Sivo, who has patiently held an unwavering belief that I would become fluent and proficient with advanced statistics and advanced research methods, I thank you for the opportunity to soar to new heights. To Dr. Thomas T. H. Wan, my sincere thanks for your keen intellectual acumen, unflagging support and wisdom regarding the research process. To Committee Members: Dr. Richard Cornell, Dr. Debby L. Mitchell and Dr. Robert Everett, your professionalism and insight are truly inspirational. To Elizabeth Killingsworth, UCF Libraries Information Literacy/Outreach Department Head, I wish to express my gratitude for unveiling the mysteries of library database searches.

My deepest gratitude goes to my wonderful husband, Rod, for his unwavering support, love and kindness in my endeavors. To my children, Brenda and Wendy, I send my love and thankfulness for your many contributions. Thank you to my parents and my brothers for their love and kindness through this long process.

To my faithful friends, Carol Barr, Linda Bonck, Sandy Donoughe, and Carolyn Polomski, my heartfelt thanks for your encouragement, laughter and chocolate.

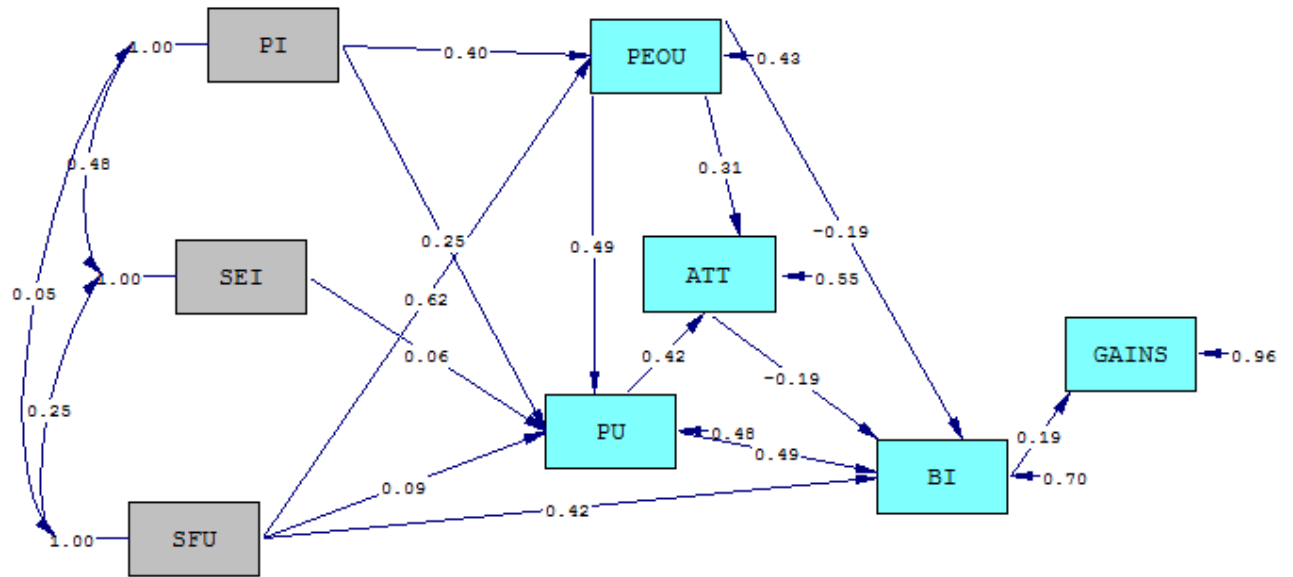
My journey through the dissertation process would not have been accomplished without the support and friendship from the Instructional Technology “Wonder Women,” Divya Bhati, Jane Madsen, Nancy Huei-Hsuan Yang and the “Stats Girls” Michele McArdle and Chanda Torres who supplied me with many doses of needed encouragement and apples.

# TABLE OF CONTENTS

LIST OF FIGURES .....	x
LIST OF TABLES .....	xi
CHAPTER ONE: INTRODUCTION.....	1
Rationale .....	7
Objectives of the Study.....	8
Purpose of the Study .....	9
Research Questions.....	10
Relevance of the Study .....	12
Limitations of the Study.....	13
Assumptions.....	13
Definition of Terms.....	14
CHAPTER TWO: LITERATURE REVIEW.....	17
Background.....	17
Theory of Reasoned Action .....	19
Technology Acceptance Model .....	21
Social Cognitive Theory .....	34
CHAPTER THREE: METHODOLOGY .....	36
Introduction.....	36
Statement of Purpose .....	36
Research Questions.....	37
Design of the Study.....	38
Survey Design and Construction .....	39

Study Participants and Sample Selection.....	40
Faculty Contact Procedures .....	41
Data Collection Procedures.....	42
Instruments.....	44
Self-Efficacy for Instruction/Computers Instrument .....	44
System Functionality and Usability Instrument.....	45
Attitude Instrument .....	45
Behavioral Intention to e-Learning Use instrument.....	45
Demographic Instrument .....	45
Data Analysis Procedures .....	45
Data Analysis .....	45
Structural Equation Modeling Overview .....	46
Parsimony Fit Indices .....	51
Incremental Fit Indices .....	52
Summary .....	54
CHAPTER FOUR: RESULTS .....	55
Introduction.....	55
Path Analysis of the Hypothesized IP-TAM Model Fit.....	55





Chi-Square=18.61, df=12, P-value=0.09849, RMSEA=0.064

.....	56
Path Analysis of the Modified IP-TAM Model Fit.....	60
Research Question 1 .....	63
Research Question 2 .....	64
Research Question 3 .....	64
Research Question 4 .....	65
Data Characteristics .....	74
Reliability.....	76
Demographics .....	77
Summary.....	79
CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS.....	81
Conclusions.....	81
Limitations .....	84

Recommendations for Further Study .....	85
Recommendations .....	87
APPENDIX A: SURVEY INSTRUMENTS .....	88
APPENDIX B: CONSENT LETTER E-MAIL DOCUMENTS .....	103
Invitation to Participate Letter .....	104
Follow-up Letter .....	107
Second Follow-up-Letter .....	109
Thank You Letter .....	110
APPENDIX C: CORRELATION MATRIX .....	111
APPENDIX D: IRB DOCUMENTS .....	113

## LIST OF FIGURES

Figure 1 Instructional Perception Technology Acceptance Model Hypothesized.....	11
Figure 2 Theory of Reasoned Action, Fishbein and Ajzen 1975.....	19
Figure 3 Technology Acceptance Model (TAM) Davis, F. 1993.....	22
Figure 4 TAM2 .....	25
Figure 5 Unified Theory of Acceptance and Use of Technology Research Model by Venkatesh, Morris, Davis and Davis, 2003 .....	27
Figure 6 CFA Model of Standardized Estimates of Hypothesized PI-TAM Model.....	56
Figure 7 Path Model of Standardized Estimates of Modified IP-TAM.....	61
Figure 8 Plotted Means for Faculty Rank Repeated Measures ANOVA .....	73
Figure 9 Modified IP-TAM .....	84

## LIST OF TABLES

Table 1 TAM Research since 1999.....	28
Table 2 PI-TAM Construct Definitions.....	35
Table 3 Program Contact Plan.....	42
Table 4 Selected Fit Indices for Both Models.....	57
Table 5 Hypothesized IP-TAM Path Analysis Equations Manifest Variable with Estimates.....	59
Table 6 Hypothesized IP-TAM Path Analysis Manifest Variable Equations (with Standardized Estimates).....	60
Table 7 Modified IP-TAM Path Analysis Equations Manifest Variable with Standardized Estimates.....	62
Table 8 Modified IP-TAM Path Analysis Manifest Variable Equations (with Standardized Estimates).....	63
Table 9 Gender.....	65
Table 10 Box's Test of Equality of Covariance Matrices(a) Work Status Full Time and Part Time Groups.....	66
Table 11 Full Time or Part Time Work Status Group Pretest/Posttest ANOVA Results.....	67
Table 12 Descriptive Statistics for Full time-Part time Group Repeated Measures ANOVA.....	67
Table 13 Box's Test of Equality of Covariance Matrices(a) Age Group Pretest/Posttest ANOVA Results.....	68
Table 14 Age Group Pretest/Posttest ANOVA Results.....	68
Table 15 Descriptive Statistics for Age Groups Repeated Measures ANOVA.....	69
Table 16 Box's Test of Equality of Covariance Matrices(a) for Faculty Rank Groups.....	70
Table 17 Faculty Rank Pretest/Posttest ANOVA Results.....	70

Table 18 Faculty Rank Tests of Within-Subjects Effects .....	71
Table 19 Faculty Work Status Means for Pretest (time 1) and Posttest (time2).....	71
Table 20 Tests of Between-Subjects Effects for Faculty Rank .....	72
Table 21 Descriptive Statistics for Faculty Rank Repeated Measures ANOVA.....	72
Table 22 E-mail Response Statistics.....	75
Table 23 Internal Consistency Reliability Coefficients .....	76
Table 24 Frequency and Intensity of Variables .....	77
Table 25 Ethnicity.....	78
Table 26 Faculty Rank .....	79
Table 27 Full Time - Part Time Status.....	79

## **CHAPTER ONE: INTRODUCTION**

“Scientific principles and laws do not lie on the surface of nature. They are hidden, and must be wrested from nature by an active and elaborate technique of inquiry” (Dewey, 1920, p. 32).

The American Health Information Management Association (AHIMA) has spent an estimated 400 to 750 hundred thousand dollars per year on the e-HIM® Virtual Lab to enhance workforce training of HIM students. Failure of the e-HIM® Virtual Lab implementation to thrive and succeed is expensive not only in terms of dollars, but on the reputation of AHIMA within the health information and informatics community of professionals, vendors and suppliers. AHIMA may have met their stated goal of signing up 100 schools before the end of 2007 (AHIMA Advantage, 2006), however, this is only 33% of the entire Commission on Accreditation for Health Informatics and Information Management Education (CAHIIM) approved or accredited academic institutions. Further, not all of the colleges or universities using the e-HIM® Virtual Lab have fully implemented and integrated the virtual lab tools into their curriculum. At a time when competition for jobs in traditional HIM roles is being challenged from other healthcare specialties (AHIMA Advantage, 2008), maintaining AHIMA’s leadership role in HIM comes from a highly skilled and well trained workforce. The e-HIM® Virtual Lab applications, from 6 software industry partners, offers hands on experiences with application software tools for electronic health records, end-coders, and other core HIM technologies. Additionally, AHIMA’s partnered with 13 academic institutions, professionals, educators, and other industry experts to create a laboratory repository of laboratory lesson plans and suggested uses (Kersten, Saigal and Owens, 2006). However, the actual use by faculty and students of the applications has been

lower than expected. This study looks at the constructs of faculty behavioral intentions.

Health information management (HIM) program faculty confront restricted academic institutional budgets and pressures from the healthcare industry to provide highly qualified technologically adept students for the healthcare workforce (AHIMA, September 24, 2007). Students are challenging universities to adequately prepare them to manage and implement increasingly complex healthcare information technologies including intricate electronic health record systems. In addition to restricted educational budgets, academic institutions currently have a 62% or more part-time or adjunct faculty workforce. These faculty, teaching in Commission on Accreditation for Health Informatics and Information Management Education (CAHIIM) approved or accredited programs, have limited availability to remain current with today's ever changing and complicated healthcare information technology applications (AHIMA, September 24, 2007). Part-time and adjunct academic faculty are typically paid for student contact hours and have very limited or no access to in-service education or conferences.

The American Health Information Management Association (AHIMA) is the credentialing organization in health information management, coding, and healthcare privacy and security. In response to the technology challenges of academic institutions, AHIMA has developed and implemented an e-HIM® Virtual Lab in 2006 to “build the appropriate academic resources to support and sustain HIM education for the future” (AHIMA Advantage, 2008). The e-HIM® Virtual Lab currently has a subscribed academic institutional audience of approximately 39% of CAHIIM accredited programs or 120 of 304 programs. Anecdotally, the overall utilization of the e-HIM® Virtual Lab by faculty and students has, to date, been disappointing (Kersten, 2007).

The carefully cultivated reputation of AHIMA and CAHIIM as a leader in healthcare

informatics and management professions is at stake, not to mention the Information technology industry support and high dollar yearly investment in the e-HIM® Virtual Lab (V-lab). The HIM faculty, as developers of the instructional plans, determine the use or nonuse of informational and instructional technologies. Standards for accreditation of the various HIM programs require student competencies to be met, not use of specific information or instructional technologies. The HIM faculty are, quite literally, the gatekeepers to the adoption and use of the V-lab. Use or non-use of the V-lab occurs are thought to coincide with faculty's perceptions of the V-lab. Perception is defined in the behavioral world as "the process of organizing and interpreting information about one's environment that has been acquired through the senses" (Perception, 1992). In the case of use or non use of the V-lab's informational technology, perception translates into reality. Reality is defined as "the culturally constructed world of perception, meaning, and behavior that members of a culture regard as an absolute" (Reality, 2006). What factors align with the use or non use of the e-HIM® Virtual Lab? This inquiry is designed to look at the factors which predict usage of informational technologies.

Usage of the V-lab by HIM faculty is not an isolated instance of non-use or reduced uage of an information technology. When information systems or technology are implemented, healthcare (Freed, 2006) and business (Dillon and Morris, 1996; Swanson, 1982, 1988) face a critical factor: user acceptance or rejection of the systems based on its requisite issues such as user attitudes, perceptions and beliefs about technology. The major user problems with information systems in healthcare range from underutilization of systems (Kukafka, Johnson, Linfante and Allegtante, 2003) to abandonment (Karsh, 2004). Estimates of information technology implementation failure rates in all industries range from one third (Kinney, 2007) to one half (Sivadas and Dwyer, 2000). Many researchers have engaged in the study of the user



adoption problems searching for ways to predict and explain the behaviors of users (Ilie, 2005, Burke, Menachemi and Brooks, 2005).

Unfortunately, user acceptance of technology doesn't just affect today's healthcare worker; the debate has spilled over into healthcare quality. In July 2006, the Institute of Medicine (IOM) of the National Academies of Science published another installment in its continuing series of reports on healthcare quality. This latest installment graphically highlights the dangers to patients in America's hospitals by reporting that when all medication errors are included, each patient is subjugated to one medication error each day (Institute of Medicine, 2006). The IOM previously published the distressing conclusion that between 44,000 and 98,000 American's die due to preventable mistakes each year (Kohn, Corrigan, & Donaldson, (Eds.), Institute of Medicine, (2000). The IOM has doggedly hounded the nation's health care delivery system because it "...has fallen far short in its ability to translate knowledge into practice and to apply new technology safely and appropriately" (Institute of Medicine, 2001). Other current researchers agree with the IOM, stating their concerns that healthcare professionals, unlike most professionals, have not been exposed to technological advances as fully as the rest of the business sector (Dunn, 2007; Schaper and Pervan, 2006-in press).

Lack of exposure and technology acceptance does not occur in a vacuum, the education of these highly trained health care professionals is of concern. Recently, the IOM (2001) and National Academy of Engineering's report, "The National Information Technology (IT) based Educational Materials Workshop Report with Recommendations" (2003) both advocate comprehensive research and implementation of instructional technology enabled education for the health professions.

While healthcare lags in technology adoption in education and the workplace, the internet

and web-based distance education and its requisite use of instructional technology at postsecondary educational institutions has affected how faculty teach and students access education (Christianson, Tiene and Luft, 2002; Selim, 2003; Wilner, & Lee, 2002). Previous studies enumerate faculty concerns with the use of technology for instruction as centered on the stress of using instructional technology, lack of design skills and time constraints (Britt, 2006). Other researchers state their concerns about the paucity of information regarding the perceptions of faculty (Santilli and Beck, 2005). Further, health professions education has not yet fully embraced the utilization of distance education (Green, Fowler, Sportsman, Cottenoir, Light, & Schumann, R., 2006; Carlson, 2004; IOM, 2003).

The lack of full adoption of instructional technologies and distance education is partially due to a lack of coordination of educational collaboration among the health profession education and accreditation systems which often operate in “silos” isolating the learners from other healthcare professionals and the coordination of technology at all levels in healthcare (National Academy of Engineering, 2003). The National Postsecondary Education Cooperative in their report on technology and its effects on postsecondary education expressed concerns regarding the current state of the research done on distance education stating there is a “...relative paucity of original research dedicated to explaining or predicting phenomenon related to distance learning” and listing among other concerns: “the reliability and validity of the instruments used to measure student outcomes and attitudes were questionable (p. 17, 2004). This sentiments are echoed by Phipps and Merisotis (2000) who also state there is little research done in the 1990’s which adequately controlled for the attitudes or feelings of the students and faculty.

A recent meta-analysis found the current technology acceptance literature relating to specifically the health professions and health care delivery area found the factors studied to date

had not been sufficiently broad and inclusive of “empirically influencing factors” (Kukafka, Johnson, Linfante and Allegante, 2003, p. 227). Clearly, the health professions have a paucity of research regarding faculty perceptions and technology acceptance. Additionally, no specific studies of Health Information Management faculty’s technology acceptance were found.

Davis’ (1985) Technology Acceptance Model is a well-known theoretical model used to empirically test the effects of systems characteristics on end user information systems and for the understanding of user acceptance practices. The TAM was developed by Davis (1985) at a time when user attitudes were discovered as a crucial factor for implementation of information system project success (Davis, 1993, Swanson, 1974, 1982, 1988), a development which Davis asserts still continues today (2004). The TAM, now a popular and much studied theoretical model, was developed from the general social psychology theory, the Theory of Reasoned Action developed by Fishbein and Ajzen (1975). The TAM posits attitudes toward using the system are posited or predicted from two factors which represent user beliefs and attitude, perceived usefulness and perceived ease of use (Agarwal & Prasad, 1999; Morris and Dillon, 1997).

In the evolution and study of technology acceptance over the last twenty years, researchers have also used Bandura’s (1986, 1997, p. 10) Social Cognitive Theory (SCT) to study users of technology in various settings. SCT is the converging relationship between an information system user’s or a “learner’s” external environment, behavior and personal factors (i.e., personal beliefs characteristics and experiences). The learner discovers, that efficacy beliefs (one has the power to produce results), reality constructs, behavior, and environmental factors converge and influence his or her life. SCT has been used for an interactional causal model of individual behavior widely used for academic research and has shown how the learner’s self-efficacy beliefs, reality constructs, behavior and environmental factors converge and affect their

usage of technology (Bandura, 1986, p. xi). Self regulatory functions are a distinctive function of SCT, allowing for faculty to set personal standards, use self reflection in light of their environment and change their behavior to the situation (Bandura, 1986, p. 18-20).

Integration of TAM and SCT has been proposed recently in the literature as a way to add individual contextual specificity to the TAM model (McFarland and Hamilton, 2006), assessing individual effects of self-efficacy (Shih, 2006), linking of external factors to the individual's perceptions and environment (Kukafka, Johnson, Linfante and Allegante, 2003) and a deeper understanding of user perceptions (Liam, S.-S., 2002).

#### Rationale

An American Health Information Management Association (AHIMA) project, the e-HIM® Virtual Lab, was developed in collaboration with commercial vendors of electronic software application products typically used in Health Information Management Departments. Developed as a “one stop” technology training platform for Health Information Management (HIM) faculty and students, the e-HIM® Virtual Lab was developed by Foundation of Research and Education (FORE) of AHIMA as many colleges and universities faced financial and procedural obstacles to implementing and maintaining the many technology based applications needed to adequately train students to become medical coders, Health Information Technicians, Health Information Managers or masters level graduates of Health Information Management or Health Informatics Programs.

The e-HIM® Virtual Lab is supported by FORE of AHIMA with in-kind support from QuadraMed Corporation, Dictaphone, Siemens Medical Solutions, Inc., McKesson, and Nauvalis Healthcare Solutions. The e-HIM® Virtual Lab is an annual subscription service available to

Commission on Accreditation for Health Informatics and Information Management Education (CAHIIM) affiliated coding, HIT, HIA or masters level educational programs.

### Objectives of the Study

The goal of this study is to better assist educators, especially Health Information Management (HIM) educators, with understanding of instructors' perceptions, attitudes and behavioral intentions for use of a virtual e-learning laboratory. The educators in the various educational programs are the decision makers regarding the actual use e-HIM® Virtual Lab as part of the classroom activities and either directly or indirectly, the purchasers of the services of the e-HIM® Virtual Lab. As with other TAM and SCT empirically based inquiries, study of the external factors, user perceptions and behavioral intentions of users may provide insights into the perceptions, educational gains and behavioral intention to use an e-learning laboratory service.

This empirical inquiry of the e-HIM® Virtual Lab may provide actual information which may be of practical significance to FORE of AHIMA regarding the specific user perceptions, behavioral intentions and purvey information about the existence, if any, of educational gains from faculty of use of the e-HIM® Virtual Lab MPI Simulation.

Understanding of one's ability to accept technology in an online environment as an educational tool is thought to be a precursor of information technology used in the rapidly evolving health information technology environment. A combination of HIM Faculty's perspective of their belief-attitude-behavior relationship (e.g. TAM) and the influence of the perception of external factors (e.g. SCT) was explored in the context of an online learning system.

The proposed inquiry is a formative quasi experimental causal survey study based on a

hypothetical model, the Instructional Perception Technology Acceptance Model (IP-TAM) based on Davis' (1985) Technology Acceptance Model (TAM) and Bandura's (1986) Social Cognitive Theory (SCT). The IP-TAM is used to investigate an inclusive set of factors which include Self-Efficacy for Instruction/Computer Self-Efficacy (SEI), Personal Information Technology Innovativeness (PI), System Functionality/Usability (SFU), which are hypothesized to affect Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude (ATT) and Behavioral Intention (BI) which ultimately affects the educational gains of the user. The outcome variable will be educational gains (GAINS) as measured by a pretest and posttest of the Master Patient Index (MPI) simulation.

The proposed study will be conducted in three parts: a) an initial survey of computer self efficacy and instructional self efficacy and a pretest (i.e., competency quiz) of Master Patient Index competency b) Faculty review of the MPI (Master Patient Index) teaching Simulation situated on the public portion of the e-HIM Virtual Lab web site (<http://campus.ahima.org/vlab/>) and c) HIM faculty posttest (i.e., competency quiz) of MPI competency and a survey of faculty perceptions regarding system functionality, usability and technology acceptance.

#### Purpose of the Study

The purpose of this study was to determine if the integrated IP-TAM explains the relationship between faculty members' acceptance of the technology and the variables: Self-Efficacy for Instruction/Computer Self-Efficacy (SEI), Personal Information Technology Innovativeness (PI), and System Functionality/Usability (SFU), which are hypothesized to affect Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude (ATT) and Behavioral Intention (BI) which ultimately affects the educational gains of the user. The outcome variable

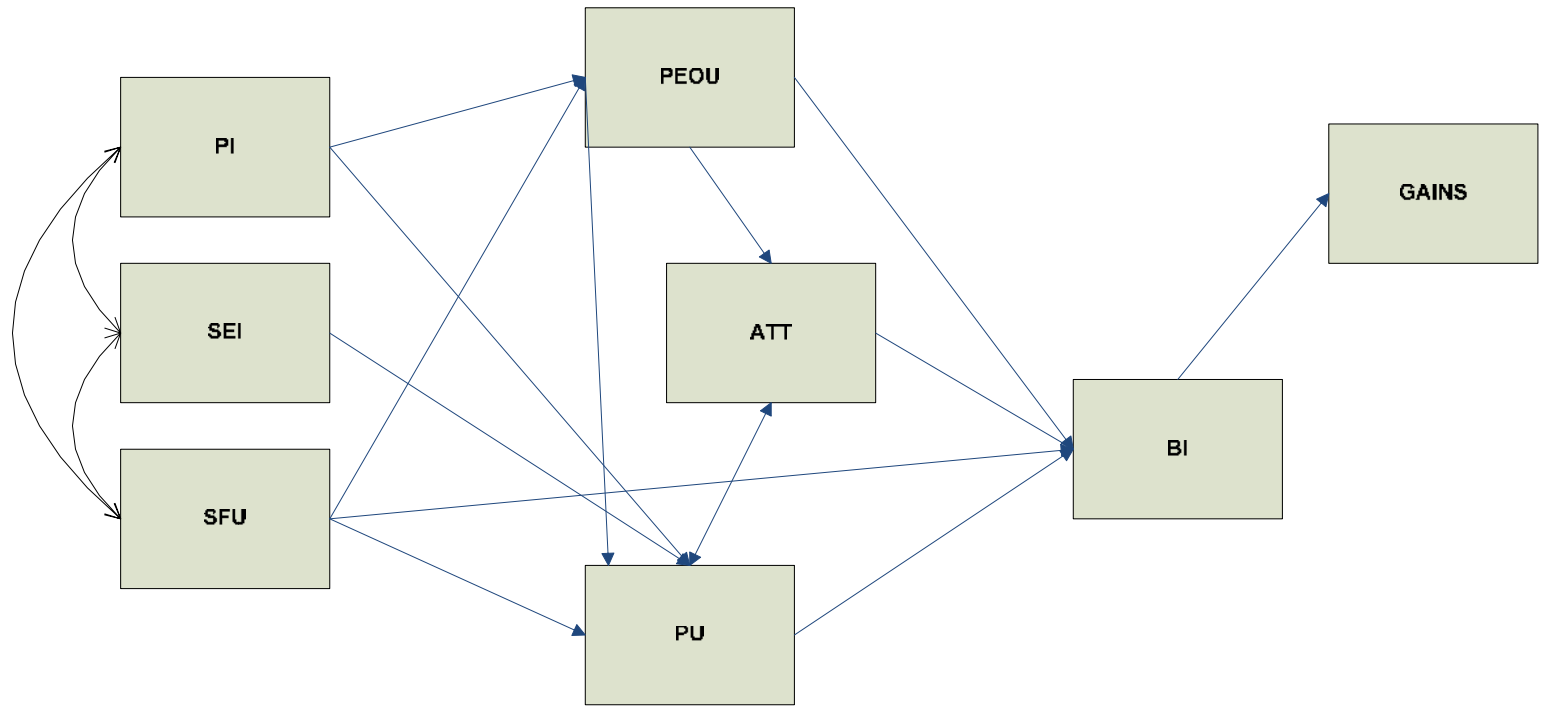
will be educational gains (GAINS) as measured by a pretest and posttest of the Master Patient Index (MPI) simulation located on the virtual e-learning lab site. Figure 1 depicts the IP-TAM as proposed in this inquiry.

### Research Questions

The research questions are as follows:

1. Does the hypothesized IP- TAM fit the data in predicting the faculty's behavioral intention to use the e-HIM® Virtual Lab?
2. To what extent does Personal Information Technology Innovativeness (PI) and System Functionality/Usability (SFU) impact the IP-TAM?
3. Are the HIM faculty's attitude and behavioral intentions to use the e-HIM® Virtual Lab's MPI Simulation determined by the Self-Efficacy for Instruction/Computer Self-Efficacy (SEI)?
4. To what extent does the MPI Simulation teach the desired concepts? Do the participants show knowledge gains evidenced by pretest and to posttest scores?

IP-TAM  
Instructional Perception Technology Acceptance Model  
Hypothesized Model



5.

Figure 1 Instructional Perception Technology Acceptance Model Hypothesized



## Relevance of the Study

The IP-TAM hypothesized inquiry was intended to assess value of combining the TAM and SCT. Researchers, including the original author of the TAM, Davis (Davis, 1989; Davis 1993; Davis, Bagozzi and Warshawe1989; Venkatesh and Davis, 2000; Davis and Venkatesh, 2004) have continually tested and updated the TAM to include outside factors not originally envisioned as a part of the TAM. The TAM and its later models, TAM2, UTAUT, are explored in the Literature Review (Chapter 2). The TAM and its predecessors has been the object of many studies, however few have included the outside variables of SFU and PI and no known studies have used the combination of faculty, HIM, and a virtual laboratory. Several investigators (Kukafka, Johnson, Linfante and Allegante, 2003;Liam, S.-S., 2002; McFarland and Hamilton, 2006; Shih, 2006) as noted previously, have called for further study and expansion of the TAM to include factors from the SCT, scilicet , contextual specificity, self-efficacy, external factors to the individual's perceptions and environmental factors. To this end the IP-TAM was hypothesized to look at the faculty's perceptions and self-efficacy for instruction/computer use as influences on technology use, specifically a virtual lab.

Further, the intent of this study was also to assist the American Health Information Management Association investigate faculty use of technology for the purpose of evaluating the virtual laboratory solution for HIM student technology application training. Due to limited financial resources, it is incumbent upon AHIMA to make educated decisions for implementing technology solutions. The significance of the study may provide insight to faculty perceptions about information technology and their requisite needs for instructional technology and application training.

## Limitations of the Study

The limitations of the study are:

1. A self-reported study may not fully portray the faculty acceptance of instructional technology due to the imperfections of the formative research design.
2. The validity of the study depends upon the honesty of the participant answers to the questions.
3. The study population did not appear to be as large as initially stated. The actual size of the Population of HIM faculty is enigmatic.
4. The HIM faculty's prior computer and internet skills will vary. The faculty at each university and college will have disparate prior experience with course management systems, instructional technology and computer training.
5. The type and quality of the internet connection used by the participants may vary.
6. The completion of the survey may be limited by the computer and software used by the individual.
7. The costs of the survey are limited.
8. Internal and external validity will be limited to the reliability of the instruments utilized.
9. The methodology and use of Structural Equation Modeling (SEM) and Path models for analysis of the IP-TAM are discussed in Chapter Three: Methodology.

## Assumptions

Some of the assumptions of the study are as follows:

1. The sample participants actually used the targeted online educational site, e-HIM® Virtual Lab before taking the posttest.
2. The participants responded to the survey honestly; and, the participants' responses were based

on their own beliefs and knowledge.

3. The validity and reliability of the questionnaire items will be tenable to allow for accurate results.
4. The participants answered the questionnaire without the interference, influence and/or help of other individuals.
5. The homogeneity of the groups of participants and non-participants' is confirmed.

### Definition of Terms

The following definitions are used in this study:

*Attitude (ATT)*: An opinion about use of the system or according to Davis (1993, p. 476), attitude is the degree to which an individual evaluates and associates the target system with his or her job.

*Behavioral Intention to use (BI)* – A prediction that if the participant had access to a system, they would use it (Venkatesh, 2000).

*DV*: Dependent variable, in a research context, the variable being predicted by independent variable(s) or a response variable.

*Health Information Management (HIM)*: “The body of knowledge and practice that ensures the availability of health information to facilitate real-time healthcare delivery and critical health-related decision making for multiple purposes across diverse organizations, settings, and disciplines (AHIMA website: [www.ahima.org](http://www.ahima.org)).”

*IV*: Independent variable, in a research context, the variable that predicts the response.

*Information Retention (IR)*: Human memory encoding, storage and retrieval. For this study pre-tests will show content knowledge prior to navigating the website, and post-tests will demonstrate content knowledge after navigation of the site. The two tests will be measure

the user's prior and post content knowledge.

*Internet:* Also known as the World Wide Web, the internet is interconnected computer networks around the world allowing for shared information.

*Model:* Representation of a Theory (Tabachnick and Fidell, 2007).

*Personal Innovativeness in the Domain of Information Technology (PI):* The degree to which a person believes that they are innovative in their use of information technologies.

*Perceived usefulness (PU):* The degree to which a person believes that use of a particular system would enhance his or her (job) performance (Davis, 1989).

*Perceived ease of use (PEOU):* The degree to which a person believes that using a particular system would be free from effort (Davis, 1989).

*Self-Efficacy:* The ability to accomplish an act or produce results utilizing cognitive skills, knowledge and transformational operations under diverse circumstances. (Bandura, p. 390-1, 1986)

*Perceived Self-Efficacy:* "People's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances Bandura (p. 391, 1986)." *Computer self-efficacy (CSE):* An individual's belief in their ability to perform a particular task using the computer (Bandura, 1977). Computer self-efficacy was defined by Venkatesh and Davis (1994) as the degree to which an individual is confident in using the power of the computer for a particular purpose as a result of accumulated, successful prior experiences. Or CSE is the reflection of one's beliefs about the ability to use computers effectively (Compeau & Higgins, 1995).

*Social Cognitive Theory (SCT):* The triadic reciprocity of behavior, cognitive and other personal factors and environment all interacting determinant of each other. The factors, while

causal, do not equally influence each other. (Bandura, p. 19, 1986)

*Subjective Norms (SN)*: The user's perception of the external forces and their motivation to comply with said forces (Robinson, 2001).

*Technology Acceptance Model (TAM)*: A model of an information system theory that represents how users come to accept and use a technology (Davis, 1989).

*Theory*: A systematic set of relationships providing a consistent and complete explanation of phenomena (Tabachnick and Fidell, 2007).

*Work Status (WS)*: The status of the faculty as at their university Program Director, Professor, Associate Professor, Assistant Professor, Instructor, Adjunct Faculty or other. WS is seen as an indicator of time and resources available to the faculty for development of instruction and exploitation of training opportunities.

## CHAPTER TWO: LITERATURE REVIEW

### Background

Betsy Lehman, a reporter from the Boston Globe, died from an overdose during chemotherapy. Ben Kolb was eight years old when he died during "minor" surgery due to a drug mix-up and Willie King had the wrong leg amputated (Committee on Quality of Health Care in America, Institute of Medicine, 2000, p.1). Regrettably, the Institute of Medicine (IOM) also informed the American public that each year between 44,000 and 98,000 American's die due to preventable mistakes each year in the United States (US) Hospitals (Kohn, Corrigan, & Donaldson, 2000). Immediate reactions to these reports prompted the US Government and the IOM to place an emphasis on healthcare quality and health information technology. Why place an emphasis on information technology? Specifically, the IOM studies revealed the US healthcare system had failed to update its information technology, use technology appropriately, to translate knowledge into patient-centered, safe, effective, timely and equitable affordable healthcare practices, namely, every other major industry in US had better information technology than the healthcare industry (Kohn, et al.2000). President Bush in 2004 called for the majority of Americans to have interoperable electronic health records within 10 years and widespread adoption of Health Information Technology (HIT) (Aspden, Wolcott, Bootman, and Cronenwett, 2007).

For over ten years, the IOM has doggedly hounded the nation's health care delivery system for the previously mentioned failures due in large part to lack of technology infrastructure, particularly information technology systems and inadequate training of the workforce, two of four main areas targeted for the healthcare system redesign by the IOM. (Aspden, et al., 2007; Institute of Medicine, 2001). Healthcare's significantly lagging

information technology adoption is the object of much study (Burke, Menachemi and Brooks, 2005; Kaushal, et al., 2005; Poon, et al., 2006). Many businesses see information technology adoption as a crucial element for any organization's success (Liaw, 2002; Igbaria, 1997). Even postsecondary education has fully embraced information technology (Snyder, Tan and Hoffman, 2005).

Extending beyond the glaring information technology weaknesses in healthcare infrastructure, education and training of healthcare professionals education has been disparaged as having woeful shortfalls in education and training capacity, being inadequately funded, and using outdated curriculum and methodologies, including a failure to embrace distance education (Aspden, et al., 2007, Institute of Medicine, 2003, p. 37;) Institute of Medicine, 2000; Institute of Medicine, 2001; Thomas and Carroll, 2006). Again, it is imperative to comprehend the pervasiveness of the problem; healthcare professionals, unlike most professionals, have not been exposed to technological advances as fully as the rest of the business sector (Burke and Menachemi, 2004; Bickford, et al., 2005; Institute of Medicine, 2003; Carlson, 2004 , Institute of Medicine 2001; Green, Fowler, Sportsman, Cottenoir, Light, and Schumann, R., 2006). The current pressures for reform find health care professionals being expected to work in a rapidly changing technological environment through at least the rest of the decade (Institute of Medicine, 2001.). Further, the National Academy of Engineering (2003) found the technology and curriculum problems with health professions education translated into a lack of technology coordination in the healthcare workplace.

The ultimate goal of this study is to better assist the educators, especially Health Information Management (HIM) educators, with managing the business of online learning, a precursor of information technology use in the professional workplace. The HIM faculty's

perspective of their belief-attitude-behavior relationship will be explored in the context of an online learning system.

The Technology Acceptance Model (TAM) was developed by Davis (1985) at a time when user attitudes were discovered as a crucial factor in information system project success (Davis, 1993, Swanson, 1974, 1982, 1988), a development which Davis asserts still continues today (2004). The TAM, now a popular and much studied theoretical model, was developed from the general social psychology theory, the Theory of Reasoned Action developed by Fishbein and Ajzen (1975).

### Theory of Reasoned Action

User acceptance and adoption problems spurred researchers to search for a model to predict and understand the actions of people. Such behavioral prediction was posited by two social psychologists, Fishbein and Azjen (1975) as the Theory of Reasoned Action (TRA). TRA is described as an actual behavior, Y, influenced by the behavioral intention (BI) being influenced by two rational paths, one personal and one reflecting social influences as shown in Figure 1 - Theory of Reasoned Action. The TRA was designed to be a general model allowing adaptation to any conscious behavior (Fishbein and Azjen, 1980, p. 246).

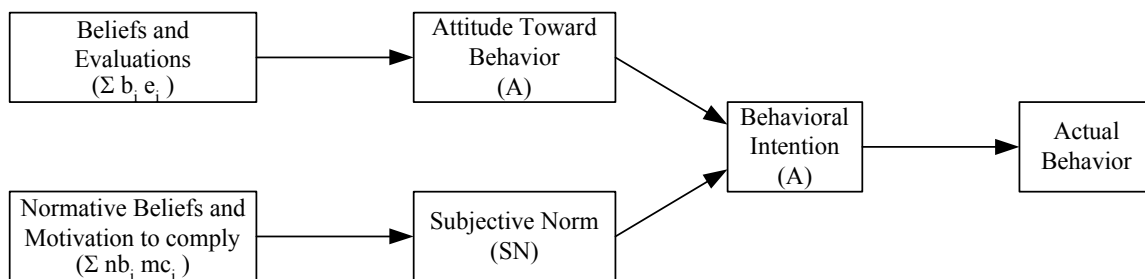


Figure 2 Theory of Reasoned Action, Fishbein and Ajzen 1975.



The personal path is the personal judgment or beliefs about the consequences of the behavior, impacting attitude or a learned evaluation, toward the BI and finally, influencing the behavior, Y. Simultaneously, a second path, social influences, is also influencing the behavior intention (BI) of the person. Normative beliefs and motivation to comply are the salient beliefs (bi) about the consequences of performing the event multiplied by the evaluation of the consequences (mc) which influences the subjective norm (SN) attitude and in turn influences BI (Ajzen and Fishbein, 1980).

The social influence path is described as normative beliefs which influence subjective norms to influence BI and then perform the behavior, Y. Ajzen and Fishbein, 1980, p.73 clarify normative belief(nb) to be the belief about the other person and that other person's behavioral prescription such as "my mother thinks I should not have a child." The subjective norm (SN) is also clarified by Ajzen and Fishbein, 1980, p. 57, to be the perception that significantly affects the action or nonaction of the behavior. Both paths, the personal and social influence, act simultaneously and are considered a prediction of one's intentions to perform the behavior, Y.

Davis, Bagozzi and Warshaw (1989) define the theory as a regression equation with estimated relative weights for the TRA as:

$$BI = A + SN.$$

Further, Ajzen and Fishbein (1980) demonstrated the TRA was able to predict and facilitate the understanding of election behavior in America and Great Britain. Each election required the contextualization of the explicit normative beliefs and subjective norms to explain voting selections. While Ajzen and Fishbein concur the psychological processes are the same for each election or event, the specific circumstances of the normative belief must be taken into account in order for the identification of the appropriate subjective norm to be correctly

identified as the intention to perform the studied behavior. Additionally, following the caveats of choosing the specific normative belief for the situation, Azjen and Fishbein and others have successfully utilized TRA as a general model for predicting consumer behavior, marketing research as well as other behaviors (Davis, et al. 1989).

### Technology Acceptance Model

The TAM posits attitudes toward using the system are predicted from two factors which represent user beliefs and attitude, perceived usefulness and perceived ease of use (Agarwal & Prasad, 1999; Morris and Dillon, 1997). Intended as a practical model, the TAM, as shown in Figure 2, theorized that a persons perceived ease of use (E), perceived usefulness (U), attitude (A), behavioral intention (BI) could be developed to show a general parsimonious model of user behavior across many types of technologies and varied populations. Like the TRA, the TAM was developed to predict and explain the phenomena of user acceptance, identifying the influence of external variables on one's U, E, A, BI and finally the influence on actual use. Acting on both A and BI, perceived usefulness (U) is defined as the users' subjective probability or belief that his or her performance using the system will be enhanced. Acting on U and A, the perceived ease of use (E) is the user's subjective belief that his or her performance using the system will be free from effort (Morris and Dillon, 1997).

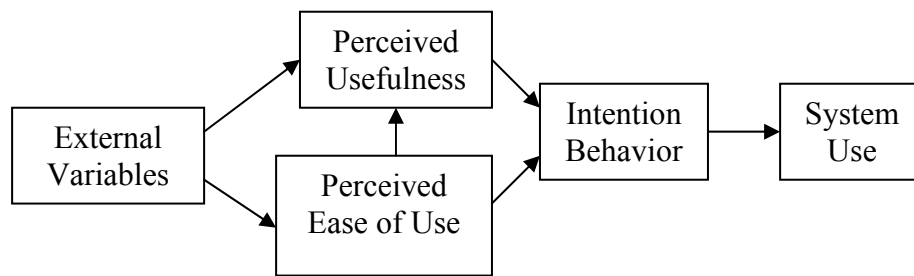


Figure 3 Technology Acceptance Model (TAM) Davis, F. 1993.

Davis, et al. (1989), occasions that people develop intentions to behave in a positive manner in the organizational/institutional setting to increase their job performance over and above their normal inclination to acquire positive or negative behaviors. These intentions are posited by the U→ BI relationship shown above. Simply put, people form their intentions toward actual use of the technology from a cognitive assessment of how the technology will improve their performance.

The TAM excludes the SN portion of the TRA. As the least understood portion of the TRA is the social influence path, Azjen and Fishbein discuss at length the task of “elicitation” salient beliefs from a sample population. Organization of the responses from the sample population is required to create model or expected salient beliefs. The belief groupings are ranked by frequency and eventually one must determine a break between the group beliefs and individual beliefs. The process of forming the subjective norm is time consuming and over all the authors were not clear if the SN was the best way to consider the influence of social pressures in the theory (1980, p.246).

Additionally, Azjen and Fishbein utilized the multiplicative effects of beliefs and evaluations to influence attitude in TRA. The interval level scaled measure introduced systematic error and a number of researchers found statistically estimated value weights provided a

descriptive method for the cognitive process which influences judgment; consequently Davis, et al. (1989) utilized statistically estimated value weights rather than self stated value weights.

The studies from Davis, (1989) and Davis, et al. (1989) found that attitudes do not fully reconcile the effects of U and E which was not the stance of Fishbein and Azjen (1975). Davis also posited external factors such as system design features should influence the beliefs users hold toward the use of system.

Bagozzi, Davis and Wasrshaw, (1992) found psychological processes, type of method and model used for training are important to evaluating the eventual usage of the system. This study used MBA students to evaluate personal computer acceptance in light of the Theory of Trying.

In 1993, Davis tested the original TAM on 112 users and found perceived usefulness (PU) 50% more influential than ease of use (EOU) in determining usage by the participants and no specific mention was made of the psychological processes involved with user acceptance.

The 1996 study by Venkatesh and Davis utilized the additional constructs of computer self efficacy before and after direct experience and found support of self-efficacy as a construct.

Confirming that user attitudes and perceptions are indeed representative of system use; researchers utilizing structural equation modeling found the TAM is supported and parsimonious (Chau,1996, Hu, Chau, Liu Sheng, and Yan Tam, 1999; Igbaria, Zinatelli, Cragg, and Cavaye, 1997). The TAM has been hypothesized by other researchers to substitute design features with information technology system user characteristics (Legris, Ingham and Collette, 2003; Pan, Sivo, and Brophy, 2003; Venkatesh, 2000).

Three Meta-analyses (King and He, 2006; Legris, Ingham and Collette, 2003; Ma & Liu, 2004) agree the TAM is a robust theoretical model to explain and understand acceptance of

technology.

King and He, 2006, compiled 88 studies in a statistical literature synthesis method largely from the business and information systems journals. Summarizing four key constructs and calculating average reliabilities for the 12000 observations, the findings showed average reliabilities for all constructs to be greater than 0.846. Over all ease of use on behavioral intention is mainly through usefulness. The authors posited students were similar moderators for professionals but not office workers and internet usage was different from job task applications general use an office applications.

Often cited in the literature is the Legris, et al., 2003, meta-analysis of 22 studies indicated the TAM2 is the evolved model and the literature reflects adding system design features similar to the improvements in the TAM2 as depicted in Figure 3- The TAM2. The authors concluded three limits of the TAM research they reviewed: 1) Nine of the 22 studies reviewed utilized students which may not adequately reflect the actual business climate, 2) few business applications were studied, and 3) Measurement of system use would be better than self reporting surveys.

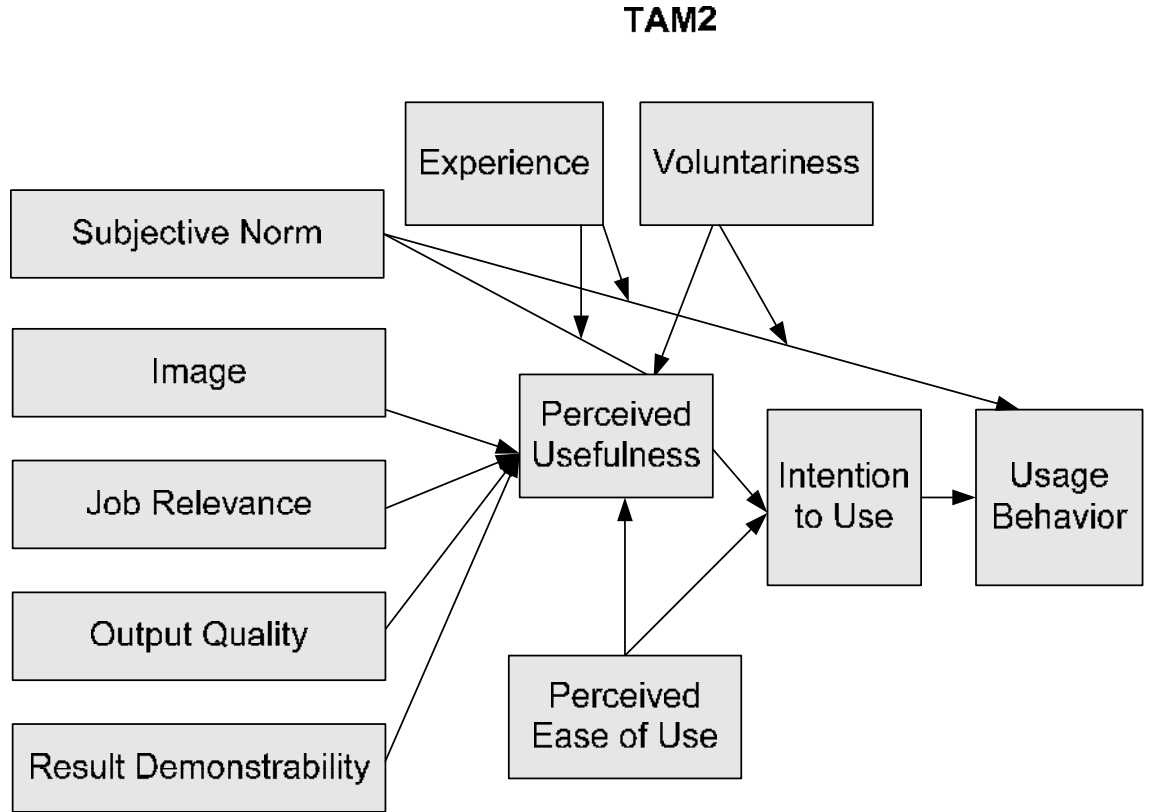


Figure 4 TAM2

The third meta-analysis, Ma and Liu, 2004, concludes perceived ease of use and perceived usefulness predict the acceptance of information technology as well as concerns about the weakness in the relationship between ease of use and acceptance. None of the meta-analyses appeared to have reviewed the recent research on e-learning and the use of Course Management Systems (CMS) in universities. Additionally, the meta-analyses did not appear to comment on the statistical methods employed in the studies, the inclusion of longitudinal data and the

inclusion of related constructs to e-learning.

Lederer, et al. (2000), analysis of whose findings validated the TAM in the WWW context included a succinct review of previous TAM research. The Lederer et al. (2000) review summarizes the most relevant studies for www or e-learning applications prior to 2000. Of the 16 studies reviewed 9 did not show attitude or intention as significant. Lederer et al. (2000) utilized a model with two constructs specifically for web usage, ease of use antecedents and usefulness antecedents as did five of the previous research studies.

Studies newer than 1999 which are relevant to WWW use and e-learning or are important theory studies are summarized in Table 1 Previous TAM Research.

Venkatesh, Morris, Davis and Davis, 2003, proposed the Research Model, Unified Theory of Acceptance and Use of Technology (UTAUT) as shown in In Figure 4. Which when studied confirmed three constructs: performance expectancy, effort expectancy and social influence. Both Gender and age were found to be moderators of the constructs as was voluntariness in one of the hypotheses.

Carswell and Venkatesh, 2002 found their research supported the Innovation-Diffusion theory and Theory of Planned Behavior Constructs (TPB).

Many of models tested with revised TAM, TAM 2, UTAUT or the research model supported context-specific constructs while still explaining some portion of behavior intention. However, caution is advised before selection of a model modification, as all results are preliminary except for the studies (Pan et al, 2003) that have replicated an existing model. More study of the modification is suggested by the recent research.

## Unified Theory of Acceptance and Use of Technology Research Model

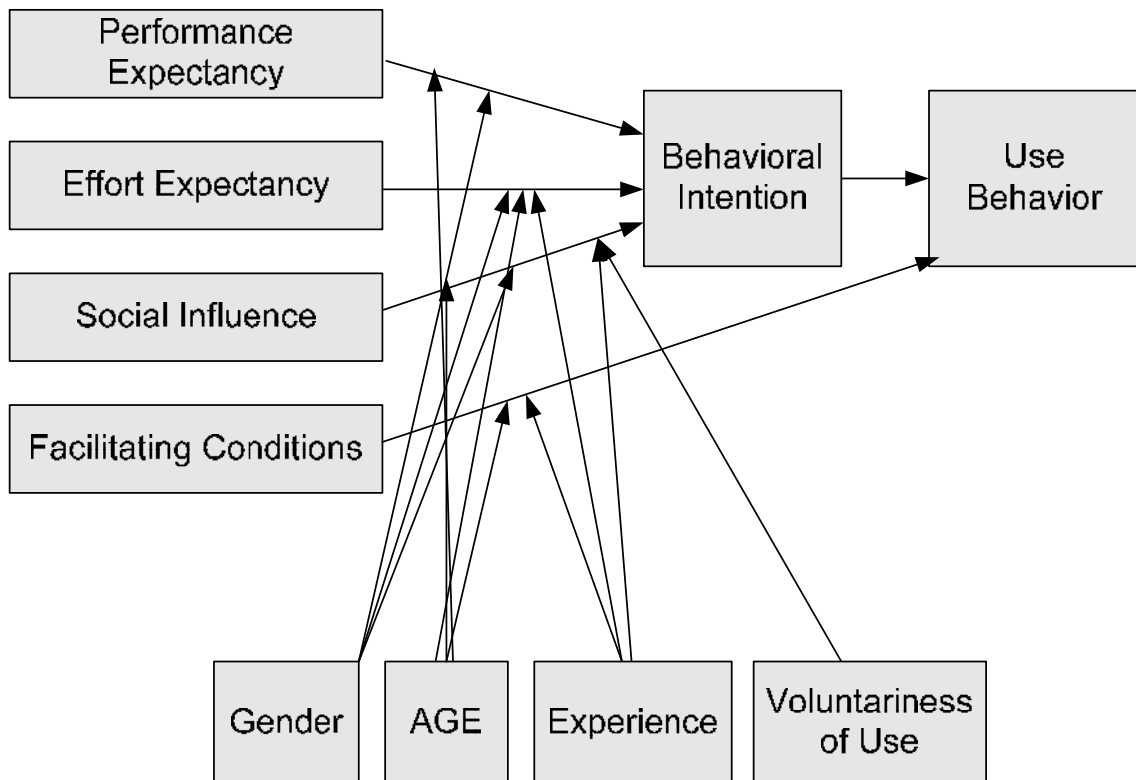


Figure 5 Unified Theory of Acceptance and Use of Technology Research Model by Venkatesh, Morris, Davis and Davis, 2003



Table 1

TAM Research since 1999

<b>Application Technology</b>	<b>Population</b>	<b>Researcher</b>	<b>Additional Constructs</b>	<b>Analysis</b>
Algebra instruction	Higher Ed Students	Sen, 2005	<b>Computer self efficacy; SN;</b> Perceived usefulness was the most significant predictor of perceived ease of use; The perceived ease of use is not the effective predictor of perceived usefulness rather perceived usefulness positively predicted perceived ease of use	Path Analysis
CMS	Higher Ed Students	Lee, 2002	Task Value, Computer self efficacy	Regression

<b>Application Technology</b>	<b>Population</b>	<b>Researcher</b>	<b>Additional Constructs</b>	<b>Analysis</b>
CMS	Graduate Students	Carswell and Venkatesh, 2002	<p>Subjective norm and perceived behavioral control, RD=result demonstrability, VIS=visibility, TR=trialability, COMP=compatibility, INVOLV=involvement, ENGAG=engagement, ALTUSE=extent of use of alternate (synchronous) media, GRADE=expected grade, INTENT=intent to continue to use.</p> <p>Results: User reactions to the technology from the two theories (Diffusion Innovation Theory and TPB )- would influence individuals' current acceptance outcomes, learning outcomes and future outcomes</p>	Regression analysis (540 students)
CMS	Higher Ed Students, Psychology, Engineering	Pan et al 2003	<p>Perceived usefulness of WebCT (CMS), attitude toward Web CT</p> <p>SN not a predictor; successfully replicated the TAM</p>	SEM

<b>Application Technology</b>	<b>Population</b>	<b>Researcher</b>	<b>Additional Constructs</b>	<b>Analysis</b>
CMS	Higher Ed Students	Ngai, Poon and Chan, 2007	Technical support	SEM
CMS	Higher Ed Students-Taiwan	Pituch and Lee, 2006	Use for supplementary learning Use for Distance Education-System functionality System Interactivity System response Self efficacy Internet experience	SEM
CMS (Course Management System)	Higher Ed Students	Stoel and Lee, 2003	Prior Experience	SEM
CMS- e-collaboration	Higher Ed Students	Dasgupta, Granger and McGarry, 2002	TAM Research Model	Regression
Desktop PC, Wireless phone simulation PDA	Higher Ed Students	Bruner and Kumar, 2005	Consumer visual orientation, Fun Internet devices	CFA
e-commerce	Higher Ed Students	Gefen, Karahanna and Straub, 2003	Trust; familiarity; disposition, purchase intentions(BI)	PLS
Intentions to take an Online instruction	students	Grandon, Alshare and Kwun, 2005	Culture, convenience; quality; self efficacy; research model	PLS-Path Analysis

<b>Application Technology</b>	<b>Population</b>	<b>Researcher</b>	<b>Additional Constructs</b>	<b>Analysis</b>
International web site-internet shopping	Higher Ed Students	Singh, Fassot, Chao, and Hoffman 2006	Cultural adaptation	Partial Least Squares (PLS)
Internet Banking	Customers	Eriksson, Kerem and Nilsson (2005)	Trust	SEM
1. Manufacturing firm 2. Personal financial services 3. Accounting services 4. International investment banking form	1. Floor supervisors-Voluntary 2. Various employees Voluntary 3. Various employees Mandatory 4. various employees Mandatory	Venkatesh and Davis, 2000	TAM2: SN, Experience, voluntariness, Image, Job relevance, Output quality Result demonstrability	CFA; Stepwise regression
Mobile Banking	e-commerce symposium attendees (purposive)	Wang, Lin and Luarn, 2005	Perceived Credibility aka Trust	SEM
Mobile Health are systems	Healthcare professional	Wu, Wang and Lin, 2007	Research Model- Self-efficacy compatibility Technical training and support	SEM
MS Word	Business Adm Students	Chau, 2001	Research Model : Computer attitude, Computer self efficacy	Path Analysis

<b>Application Technology</b>	<b>Population</b>	<b>Researcher</b>	<b>Additional Constructs</b>	<b>Analysis</b>
1. Online meeting manager	4 organizations – over 6 months	Venkatesh, Morris, Davis and Davis, 2003.	Compared 8 competing models:	PLS with Bootstrapping
2. Database application	1.Product development			
3. Portfolio analyzer	2.Sales		TRA	
4. Accounting system	3.Business account mgmt 4.Accounting		TAM MM TPB, C-TAM-TPB, MPCU, IDT, SCT,  Proposed Model: UTAUT, 3 moderators: Gender, age , experience, voluntariness,  BI was high in mandatory and voluntary groups; performance expectancy, effort expectancy and social influence were significant constructs.  No influence from PBC at all	

<b>Application Technology</b>	<b>Population</b>	<b>Researcher</b>	<b>Additional Constructs</b>	<b>Analysis</b>
Patient Care information System	Nurses	Rawstorne, Jayasuria and Caputi , 2000	SN; mandatory environment (Perceived voluntariness)	PATH (n = 61)
PDA	Physicians	Yi, Jackson, Park and Probst, 2006	Innovativeness	SEM
Sales force Automation System	Sales Force	Robinson, Marshall, and Stamps 2005	Personal and organizational Innovativeness Support services Perceived control Length of service	SEM
Telemedicine technology	Physicians	Chau and Hu, 2001	Comptability, Perceived behavioral control, SN	Same study as 2002; additional factor
Telemedicine technology	Physicians	Chau and Hu, 2002	Perceived behavioral control (Positive Relationship; SN (No positive relationship to other variable; No predictor explained 50 of BI).)	SEM
Telemedicine technology	Physicians	Hu, Chau, LIU, Sheng and Yan Tam, 1999	Partial TAM	SEM
Web site	Higher Ed Students-Taiwan	Lin and Lu, 2000	Extended Research TAM : IS Quality: Response time, Information quality and system accessibility	Path Analysis

## Social Cognitive Theory

Bandura's (1997, p. 10, 1986) Social Cognitive Theory is the converging relationship between a learner's external environment, behavior and personal factors (i.e., personal beliefs characteristics and experiences). The learner discovers, that efficacy beliefs (one has the power to produce results), reality constructs, behavior, and environmental factors converge and influence his or her life.

Bandura's (1997) perceived self-efficacy is portrayed as belief in one's aptitude to manage and accomplish a course of action or actions (p. 4). More specifically, Bandura (1997) posits that self-efficacy in advanced cognitive functioning is important when the obstacles of "technological innovations" and changing social practices (p. 239) force the student to adapt and proffer extended efforts of a protracted nature, the Self-Efficacy beliefs contribute significantly to scholastic performance. The academic efficacy research predicts grades, career options and persistence (p. 239). Self-esteem is a judgment of one's worth and is different form self efficacy. Bandura's social cognitive theory regarding Self-Efficacy influences developmental trajectories (p. 237).

Perceived self-efficacy is multifaceted and rarely measured fully in its impact on academic anxiety as it is belief in one's control of intrusive thinking, regulation of study activities and amelioration of distress (Bandura, 1997, p. 236).

Computer self-efficacy was defined by Venkatesh and Davis (1994) as the degree to which an individual is confident in using the power of the computer for a particular purpose as a result of accumulated, successful prior experiences. The proposed model is an integration of SCT and the TAM.

Table 2

## PI-TAM Construct Definitions

<b>Construct</b>	<b>Definition</b>	<b>Reference</b>
<b>Self-Efficacy for Instruction and Computers(SEI)</b>	“Teachers’ sense of efficacy for instructional strategies refers to a person’s confidence that he or she can design and implement activities, tasks, and assessments to facilitate student learning.” The degree to which an individual is confident in using the power of the computer for a particular purpose as a result of accumulated, successful prior experiences and CSE is the reflection of one’s beliefs about the ability to use computers effectively.	Wolters, C.A. & Daugherty, S.G. (2007), Davis (1994), Compeau & Higgins (1995)
<b>Personal Innovativeness IT (PITI)</b>	The degree to which a person is willing into adopt new technologies.	Sahin & Thompson, (2006).
<b>System Functionality (SFU)</b>	The extent to which the Systems limits access to information technology and internal support	Wolters, C.A. & Daugherty, S.G. (2007) Sahin & Thompson, (2006) and Park (2004).
<b>Perceived Usefulness (PU)</b>	The degree to which a person believes that use of a particular system would enhance his or her (job) performance (Davis, 1989)	Stoel & Lee (2003)
<b>Perceived Ease of Use (PEOU)</b>	The degree to which a person believes that using a particular system would be free from effort (Davis, 1989)	Stoel & Lee (2003)
<b>Behavioral Intention to use e-learning use (BI)</b>	A prediction that if the participant had access to a system, they would use it (Venkatesh, 2000).	Stoel & Lee (2003)
<b>Attitude toward e-HIM Virtual Lab (ATT)</b>	A behavioral response of reported actual use of the system as measured by the individual’s reaction in real life (Davis, 1993). The amount of real time spent on the actual computer.	Stoel and Lee (2003).



## **CHAPTER THREE: METHODOLOGY**

### **Introduction**

This chapter describes the purpose of the study, research design, context of the study, participant selections instrumentation, the procedures of data collection and data analysis. The intent of the chapter is to provide the proposed procedures and their implementation as they relate to the research questions and variables under investigation. The chapter endeavors to provide sufficient detail to judge the ability of the methodology to provide accurate results.

### **Statement of Purpose**

The purpose of this study was to determine if the hypothesized IP-TAM explains the relationship between faculty members' acceptance of the technology and the variables: Self-Efficacy for Instruction/Computer Self-Efficacy (SEI), Personal Information Technology Innovativeness (PI), and System Functionality/Usability (SFU), which are hypothesized to affect Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude (ATT) and Behavioral Intention (BI) which ultimately affects the educational gains (GAINS) of the user. The outcome variable was educational gains (GAINS) as measured by a pretest and posttest of the Master Patient Index (MPI) simulation located on the virtual e-learning lab site. Figure 1 depicts the IP-TAM as proposed in this inquiry which integrated self-efficacy for instruction/computers (SEI) and System Functionality and usability (SFU).

The study proposed to elicit the extent to which prior experience with computers influences the use of e-HIM® Virtual Lab (actual system use) and the faculty's competency quiz

score.

The IP-TAM was extended to include the additional outcome variable from the competency quiz, knowledge gains (GAINS). Recent articles have shown that external and moderator variable do have effects on technology acceptance (Burton-Jones, & Hubona, 2006; Liaw, Chang, Hung, & Huang, 2006; Sun & Zhang, 2006).

Prior to implementation of the study, consent forms, proposed research methods and the research plan was approved by the University of Central Florida (UCF) Institutional Review Board. The UCF IRB has as its purpose to that all human research proposals are reviewed before the research is conducted to determine whether the research plan is ethical and has adequate protections for the participants. The UC F IRB approved the research proposal.

### Research Questions

The research questions are as follows:

1. Does the hypothesized IP- TAM fit the data in predicting the faculty's behavioral intention to use the e-HIM® Virtual Lab?
2. To what extent does Personal Information Technology Innovativeness (PI) and System Functionality/Usability (SFU) impact the IP-TAM?
3. Is the HIM faculty's attitude and behavioral intentions to use the e-HIM® Virtual Lab's MPI Simulation determined by the Self-Efficacy for Instruction/Computer Self-Efficacy (SEI)?
4. To what extent does the MPI Simulation teach the desired concepts? Do the participants show knowledge gains evidenced by pretest and posttest scores?

## Design of the Study

This proposed study was a formative correlational quasi experimental causal survey study to test the hypothetical IP-TAM which was based on Bandura's Social Cognitive Theory (1986) and the Davis (1986) Technology Acceptance Model with the additional variables SEI, PI and SFU. The design proposed was a one group design pretest and posttest design.

The TAM is based on the Theory of Reasoned Action (Fishbein and Ajzen, 1975) which is a theory with a fairly large number of variables. It is the opinion of some researchers that the use of univariate statistical procedures or bivariate correlations with limited numbers of variables does not allow for understanding of complex theoretical models such as the TAM, TAM2, UTAUT, or IP-TAM (Schumacker and Lomax, 2004, p. 7). This inquiry used Path Analysis which is one of the four types of Structural Equation Modeling (SEM). There are many different names for the use of the correlation or covariance input data taken from the independent, dependent, mediating and moderating variables: Modeling of Causal Modeling, Latent Variable Modeling (LVM) or Covariance Structural Analysis (Schumacker and Lomax, 2004; Shadish, Cook and Campbell, 2002). The data used for the Path Analysis was analyzed using SPSS 15.0 and SAS 9.1. The pretest and posttest results were analyzed with a General Linear Model Repeated Measures ANOVA using SPSS 15.0.

The proposed study was conducted in three parts: a) an initial survey and a pretest (i.e., competency quiz) of Master Patient Index competency b) faculty review of the MPI (Master Patient Index) teaching Simulation situated on the public portion of the e-HIM Virtual Lab web site (<http://campus.ahima.org/vlab/>) and c) HIM faculty posttest (i.e., competency quiz) of MPI competency and a survey of faculty perceptions regarding system functionality, usability and technology acceptance.

AHIMA Director of Research, Susan Fenton, PhD, Virtual Lab Director, Sandra Kersten and Carol Nielsen, Senior Manager, Grants and Sponsored Programs FORE Research at AHIMA/FORE reviewed the design of the proposed study as subject matter experts (SMEs).

### *Survey Design and Construction*

The actual web-based survey instrument was designed using the Survey Monkey tool and the recommendations from the Tailored Design Method by Dillman (2000) and the recent research results from Dillman and Smyth (2007). The survey instrument was designed to have two separate pages and the writing was large and employed high contrast. The survey employed the following items which were reported by Dillman and Smyth (2007) to reduce measurement error: judicious use of the forced choice format and consistent use of the single column scalar presentation.

This survey required the respondents to leave the web-based survey instrument and utilize the e-HIM® Virtual Lab MPI Simulation and return to the web-based survey. Madsen, 2007, found an attrition drop-off rate of almost 47% of the respondents. Further, 60% of Madsen's drop off respondents did not return following navigation to the second internet site. Madse/s study speculated the instructions for resuming the study were not clear. This author followed the recommendations from Dillman and Smyth (2007) for web based survey construction for clear articulation of instructions, incorporation of screen shots of the MPI Simulation and using "conversational" tone for the instructions.

Other aspects of the survey design are below.

### *Study Participants and Sample Selection*

A cluster random sample of faculty was chosen from the program directors and faculty who teach at CAHIIM--the Commission on Accreditation for Health Informatics and Information Management Education approved or accredited Health Information Management (HIM) programs, specifically approved Master's programs, accredited Health Information Administration (HIA) bachelor degree programs, Health Information Technology (HIT) associate degree programs, and approved Coding programs. All faculty are members of the American Health Information Management Association (AHIMA) as a requirement of CAHIIM.

There are 304 total approved or candidacy HIM educational programs in the United States. All programs have at least 1-2 full or part time faculty and several (3-6) adjunct instructors, projecting a potential instructor population of approximately 1400 to 3000. The CAHIIM Annual Program Assessment Report (APAR) shows there are approximately 3000 educators associated with CAHIIM accredited programs. However, according to the executive director of CAHIIM, Claire Dixon-Lee, Ph.D, there is no one comprehensive list of the names of the AHIMA educators (personal communication, Dixon-Lee, 2007).

Faculty participation in the study was voluntary.

The random number generator at Randomizer.org (<http://randomizer.org/>) was used to select the programs by type (HIA, HIT, Coding) from the list of current programs generated from the CAHIIM website.

From the randomized list of schools, the directors of the programs were contacted for faculty names and email addresses. All of the Program Director's of the CAHIIM Approved Coding programs, Health Information Administration baccalaureate degree (4 year programs), Health Information Technology associate degree (2 year programs) and Masters' programs have

contact information which is listed on the website for CAHIIM. The CAHIIM website is <http://www.cahiim.org/>.

If specific faculty email contact information was not available on the CAHIIM website, the researcher attempted contact in one or all of the following ways: 1) Viewed the school or college website and attempted to obtain email addresses 2) Telephoned the program or college followed by sending an email letter to the HIA, HIT or Coding Program Director asking for faculty/instructor contact information (The program telephone numbers were listed on the CAHIIM website).

Also, distribution of a recruitment flyer asking for email contact information of faculty/educators was distributed at the Assembly on Education Luncheon at the 79th AHIMA Annual Meeting and Convention in Philadelphia, PA in October, 2007. The American Health Information Management Association (AHIMA)/Foundation of Research and Education (FORE) staff are interested in helping their members advance their research agenda. Permission to distribute a recruitment circular was received from AHIMA/FORE. Any email addresses from the recruitment flyer distributed at the AHIMA Convention that match with the randomized list of schools were contacted directly with the consent letter.

Any names of faculty from schools not chosen to be participants will be sent a thank you letter. The unused names, email addresses and thank you letters will be destroyed following the successful contact of faculty to meet of the minimum sample size for 125 or higher.

#### Faculty Contact Procedures

The sampling plan included e-mailing HIM faculty and obtaining contact information for all types of faculty. The researcher utilized the Tailored Design Method by Dillman (2000) to

contact the faculty via email. The researcher endeavored to obtain faculty contact information from email contact with the Coding, HIT, HIA and Masters Program Directors. Table 3 am Contact Plan.

Table 3

Program Contact Plan

Type of Program	Number	Number of Programs to be Contacted
<b>Masters approved Programs</b>	<b>3</b>	<b>3</b>
Baccalaureate Program (4 year schools) CAHIIM Accredited	47	
School Programs in Candidacy	4	
<b>HIA- Total</b>	<b>51</b>	<b>41</b>
Associate Degree Schools (2 year Program) CAHIIM Accredited	197	
Associate Degree School Programs in Candidacy	19	
<b>HIT Total</b>	<b>216</b>	<b>177</b>
Approved Coding Certificate Program Programs (AHIMA Approved)	34	28
<b>Grand Totals</b>	<b>304</b>	<b>249</b>

#### Data Collection Procedures

The approved CAHIIM Coding Program Directors, HIT and HIA Accredited Program Directors and the Masters Level Program Directors were sent a letter requesting the faculty email addresses and a consent for the study (APPENDIX B). Following receipt of an email from the

program director, the individual faculty, i.e. the participants, were sent an email letter. The email letter contained a link to the survey. Some faculty were contacted via the email addresses found on the individual University web sites. Some program directors forwarded the email directly to their faculty.

An email thank you/ reminder with another link to the survey was sent to the participants one week following the sending of the email letter. A second thank you letter reminder was sent 2 -3 weeks after the initial email. And a final reminder thank you letter was sent 3 - 6 weeks after the initial email linked letter to the participants.

The data was collected via an online survey service, Survey Monkey. The survey used S “SECURE SOCKETS LAYER (SSL)” which is used for transmitting information privately over the internet.

There are no anticipated risks. Participants were free to withdraw and several participants discontinued participation, however 90% of participants who began the survey completed the survey.

Participant responses were collected anonymously, analyzed and reported to protect their privacy. The information was encrypted and kept on a secured external hard disc and is password protected.

Physical documentation (Recruitment Flyers) were filed in a locked secure file, accessible to only the principal investigator. The physical documentation was destroyed after completion of data collection or at the direction of UCF IRB committee. The study data will be kept until the dissertation and publication of results in scholarly journals are completed. The UCF IRB will be notified of the status of the data each year or as required.



## Instruments

The following instruments were used in the data collection: (1) Self-Efficacy for Instruction /Computers Instrument (2) Personal Innovativeness (PI) (3) System Functionality/Usability (SFU) (5) Perceived Usefulness (PU) (6) Perceived Ease of Use (PEOU) (7) Attitude toward the e-HIM® Virtual Lab (ATT) (8) Behavioral Intention to use e-learning use (BI).

Six (6) Master Patient Index Competency Questions were used for a pretest and posttest to obtain knowledge gains (GAINS). The pre test and posttest were used to measure competency gains from the MPI Simulation. Demographic information was requested which included Gender, part-time and full-time work status and faculty role to be use as sorting variables for the pretest/ post test knowledge GAINS ANOVA.

Definitions and questions to be associated with these constructs are included in Figure XX - The PI-TAM Constructs. The variables were measured on a five-point Likert scale starting from “Strongly Disagree”, Disagree”, “Neither Disagree or Agree”, “Agree”, “Strongly Disagree” and “Not Applicable.” The instrument questions are included in Appendix A.

### *Self-Efficacy for Instruction/Computers Instrument*

The Self-Efficacy for Instruction instrument was adapted from the validated instrument of Wolters and Daughterty (2007) who adapted their instrument from Bandura (1977) and specifically from Tschanned-Moran and Woolfolk Hoy. The instrument was validated and all of the items have a Rotated Factor score greater than .69. The Computer Self Efficacy questions were adapted from Compeau and Higgins, 1995 and Pan, 2003.

### *System Functionality and Usability Instrument*

The System Functionality and Usability instrument is adapted from Madsen, 2006; Sahin & Thompson, 2006; Park, 2004; Wolters, C.A. & Daugherty, S.G. (2007).

### *Attitude Instrument*

The Attitude Instrument adapted from Stoel and Lee (2003) and is adapted to the specific setting to be tested, the e-Him® Virtual Lab.

### *Behavioral Intention to e-Learning Use instrument*

These instruments are adapted from Stoel and Lee (2003) and Park 2004.

### *Demographic Instrument*

The demographic instrument is adapted from Pan 2003, Park 2004 and Wang 2007.

### Data Analysis Procedures

Data Tabulation and Path Analysis used SPSS v. 15.0, LISREL 8.80 (Student Version) and SAS 9.1. The data analysis for knowledge gains was done using General Liner Model Repeated Measures ANOVA using the pretest and posttest scores.

### Data Analysis

The causal relationships between observed variables for the hypothesized theoretical model, IP-TAM, were analyzed using a path analysis design. The continuous independent variables were measured using a five point Likert scale. The following instruments were used in

the data collection: (1) Self-Efficacy for Instruction /Computers Instrument (2) Personal Innovativeness (PI) (3) System Functionality/Usability (SFU) (5) Perceived Usefulness (PU) (6) Perceived Ease of Use (PEOU) (7) Attitude toward the e-HIM® Virtual Lab (ATT) (8) Behavioral Intention to use e-learning use (BI).

Six (6) Master Patient Index Competency Questions were used for a pretest and posttest to obtain knowledge gains (GAINS). The pre test and posttest was used to measure competency gains from the MPI Simulation. Demographics were also requested.

Correlations were calculated between the above named nine variables using SPSS 15.0 factorial analysis procedure.

#### Structural Equation Modeling Overview

Structural Equation Modeling (SEM) also known as, covariance structure analysis, latent variable models or structural modeling, is a multivariate statistical procedure combining portions of multiple regression, path analysis and factor analysis which allows the researcher to test a hypothetical model *based on theory* using a series of dependent relationships simultaneously among measured variables and latent constructs as well as between the constructs (Schumacker and Lomax, 2004). The advantages of using SEM for statistical modeling are: the entire model is tested simultaneously in light of theory; multiple dependent variables are allowed and accommodate latent variables; statistical estimation is improved with SEM which allows measurement error to be taken into account to provide more accurate estimates of the relationships between constructs (Hair, Black, Babin, Anderson, and Tatham, 2006. Tabachnick and Fidell (2007) indicated SEM estimating and removing measurement error allows for accounting the reliability of measurement and difference within and across people across time

which can be examined as well as multilevel modeling. Unfortunately, the flexibility of SEM as a confirmatory technique that allow simultaneously tests of all relationships has some negatives: SEM is based on covariance, it is complex, requires a relatively large sample size, is somewhat nebulous, assumes linearity and multivariate normality and may miss non-linearity.

According to Hair, et al. (2006), the six stages of SEM are as follows:

1. Developing individual constructs
2. Developing the overall measurement model
3. Designing a study to produce empirical results
4. Assessing the measurement model validity
5. Specifying the structure model
6. Assessing structural model validity

According to Tabachnick and Fidell (2007), in SEM, when a model is specified, parameters for the model are estimated using sample data and the parameters are used to produce the population covariance matrix. Only identified models can be estimated. A model is identified if there is a unique numerical solution for each of the parameters. So, the first step is to count the numbers of data points and the number of parameters to be estimated. The number of data points is the number of sample variances and covariances.

The equations for each procedure are previously stated in the section on estimation procedures: Maximum Likelihood Estimators - MLE: the most common estimator which is more efficient and unbiased than ordinary least squares OLS, but potentially sensitive to nonnormality. 2) Unweighted Least Squares Estimators - ULS and 3) Generalized Least Squares Estimators – GLS. The number of parameters is found by adding together the number of regression coefficients, variances, and covariances that are to be estimated. If there are *more* data points

than parameters to be estimated, the model is overidentified, which is a **necessary condition** to proceed. If there are the same numbers of data points as parameters to be estimated, the model is just identified. In this case, the estimated parameters perfectly reproduce the sample covariance matrix, chi square and  $df = 0$  and the analysis cannot test the hypotheses regarding adequacy of the model, but you can test the specific paths in the model. If there are fewer data points than parameters to be tested and then to be estimated, the model is underidentified and the parameters cannot be estimated. So, one has to fix the parameters by deleting, constraining, or fixing to a specific value or constrain one parameter equal to another parameter. The next step in model identification requires examination of the measurement portion of the model, which is the part of the model that deals with the relationship between the measured indicators and the factors. It is both necessary to establish the scale of each factor and to assess the identifiability of the measurement model. To establish the scale of the factor, one can fix the variance for the factor to 1, change the regression coefficient to 1- from the factor to one of the measured variables. The regression coefficient being fixed to value of one gives the factor the same variance as the measured variable. Also, if the factor is an Independent variable (IV) one can choose one of the previous choices. If the factor is a Dependent Variable (DV) apparently most researchers fix the regression coefficient to 1. To establish the identifiability of the measurement portion of the model, the number of factors, and the number of indicators (variables) loading on each factor are set. If there is only one factor, the model may be identified if the factor has at least three indicators with non-loading zero loading and the errors (residuals) are uncorrelated with one another. If there are two or more factors, consider the number of indicators for each factor. If each factor has 3 or more indicators, the model may be identified if errors associated with the indicators are not correlated; each indicator loads on only one factor and the factors are allowed

to covary. If there are only two indicators for a factor, the model may be identified if there are no correlated errors each indicator loads on only one factor and none of the variables or covariances among the factors is zero. The next step in establishing model identifiability is to examine the structural portion of the model by looking only at the relationships among the latent variables (factors). Looking only at the structural portion of the model that deals with the regression coefficients relating latent variables to one another, as if any of the latent DVs predict each other (beta matrix is all zeros)? If they do not, the structural part of the model may be identified. If the latent DVs do predict one another, look at the latent DV's in the model and ask if they are recursive. If the model is recursive (no feedback loops) then the structural part of the model may be identifiable.

The structural model and the measurement model are both shown on one overall model. The path diagram shows a complete set of constructs and indicators shown in the measurement model and the structural relationships among constructs. The path analysis process estimates the strength of each relationship portrayed as a straight to curved arrow in a path diagram. With estimates for each path, an interpretation can be made of each relationship represented in the model. When the statistical inference tests are applied, one can assess the probability that the estimates are significant (not equal to zero). These estimates can be used like regression coefficients to make an estimate of the values of any construct in the model. Because regression coefficients can be used to compute predicted values for dependent variables ( $\hat{y}$  - y hat), any particular values of the predictor variables allows us to obtain an estimated value for the outcome. The difference between the actual observed values for the outcome and the dependent variable ( $\hat{y}$  - y hat) is error. SEM can, fortunately, provide estimated values for exogenous constraints when multiple variables are used to indicate the construct. There are several potential

relationships between constructs where one doesn't expect a direct relationship between these constructs.

In specifying the measurement model, one identifies each latent construct to be included in the model. The measured indicator variables are assigned to the latent constructs. The measurement model can be described by a model diagram or by equations. Estimation of the complete measurement model involves specification of additional terms (i.e. error terms for each indicator). Specification of the measurement model is usually straightforward, but there are issues to be addressed according to Hair, et al. (2006): 1) Can the research support the validity and unidimensionality of the constructs? Essential points must be engaged in establishing the theoretical basis of the construct and measures. 2) How many indicators should be used for each construct? What is the minimum number of indicators? Is there a maximum? What are the trade-offs for increasing or decreasing the number of indicators? 3) Should the measures be considered as portraying the constructs (meaning that they describe the constructs) or seen as explaining the construct (combine indicators into an index)? Each approach brings with it differing interpretations of what the construct represents. The research must have well developed and established scales. The researcher must still determine validity and unidimensionality in this specific context. In any scale development effort, issues regarding numbers of indicators and type of construct specification must be addressed.

Mulaik (1998) states that in SEM, the model hypothesis developed a priori. The hypothesis is tested against data independently from the data used in the formulation of the hypothesis because that is the "way we judge the objective validity of the hypothesis." Mulaik continues in the article to make the same points as Stephen A. Sivo, Ph.D. (2006) who states, "anyone can, through trial and error, fit the data to a model," which necessarily makes the

models lack objectivity.

When tested for parsimony, if there is no significant difference, the researcher concludes that the effects dropped from the saturated model were not needed to explain the observed distribution of data in the table. The researcher explores in this manner until the most parsimonious model which still has acceptable fit is found.

Raykov and Marcoulides (1999) discuss the concern that rigid application of the parsimony principle may be misleading because the principle may suggest choosing an incorrect model that is more parsimonious and rejecting the correct model is less than parsimonious.

#### *Parsimony Fit Indices*

Parsimony Goodness-of-Fit Index (PGFI) and the Parsimony Normed Index (PNFI) are the Parsimony Fit Indices measures of overall goodness-of-fit representing the degree of model fit per estimated coefficient. This measure attempts to correct for any overfitting of the model and evaluates the parsimony ratio of the model compared to the goodness-of-fit. These measures complement the other types of goodness-of-fit measures, absolute fit and incremental fit measures. The PGFI and the PNFI can't be used alone, but have to be used as a comparison between two models to be relevant.

The parsimony ratio (PR) of any model forms the basis for the PGFI and the PNFI. The parsimony ratio is the ratio of degrees of Freedom used by a model to the total degrees of freedom available. McDonald and Marsh (1990) note, the TLI is an unbiased estimator of a quantity that includes the parsimony ratio.



### *Incremental Fit Indices*

The Normed Fit Index (NFI), the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), and the Relative Noncentrality Index (RNI) are all Incremental Fit Indices according to Hair, et al. (2006). The Incremental Fit indices differ from absolute fit indices in that they assess how well a specified model fits relative to some alternative baseline model or null model which assumes all observed variables are uncorrelated (Hair, Black, Babin, Anderson & Tatham, 2006). Model comparison is very important and nested models may be compared by chi-square difference tests, incremental indices. Incremental indices capitalize on the fact that the null model is always nested within any specified model. The null model simply posits that  $p$  variables are uncorrelated. Discrepancies between these two models represent how much better the specified model fits than the null model (Sivo, 2006).

In contrast, the Absolute Fit Indices are a direct measure of how well the model specified by the researcher reproduces the data. The Absolute Fit indices are:  $\chi^2$  statistic, Goodness of fit (GFI) and Root Means Square Residual (RMSR) and the Standardized Root Means Square Residual (SRMSR) and the Root Means Square Error of Approximation (RMSEA) and the Normed  $\chi^2$ , Expected Cross-Validation Index, (ECVI), Actual cross validation index (CVI), and Gamma Hat. These indices assess how well a model fits relative to some alternative baseline model.

The NFI or Normed Fit Index is the original fit indices calculated as the ratio of  $\chi^2$  value for the fitted model and a null model divided by the  $\chi^2$  for the null model with the perfect fit at the value 1. The Value ranges between 0 and 1. The CFI is derived from this index and tried to include model complexity in a fit measure.

The CFI or Comparative Fit Index is an improved version of the NFI which is normed

with values also between 0 and 1. Models less than .90 are not considered to usually be fitted well.

TLI or the Tucker Lewis Index is older than the CFI, however the TLI is not normed so its values can range below 0 and above 1. A good model is one that approached 1. Apparently the TLI and the CFI generally provide similar values according to Hair, et al. The TLI is also known as the Bentler and Bonnet's non-normed fit index (NNFI) is often used because Marsh, Balla, and McDonald (1988) found that it was the only widely used index relatively independent of sample size. McDonald and Marsh (1990) note, the TLI is an unbiased estimator of a quantity that includes the parsimony ratio.

RNI or the Relative Noncentrality Index compares the observed fit from a tested specified model to that of a null model. The high value represents a better fit and like the CFI values below .90 are not usually associated with a good fit.

According to Hair (200x), the TLI and CFI are used most often.

Sample Size does affect the Fit indices according to Sivo, et al. (2006) who studied the subject of “optimal cut off values” for fit indices. Their study found that the recommendation of .95 for any class of indexes may be inappropriate, ignoring the issue of sample size. Except for the SRMR when the .05 criterion is sufficient across sample size conditions, unlike other fit indexes for which a higher value indicates better model fit.

In addition Sivo, et al., (2006) showed that the result from their study suggests that larger sample sizes offer more precision in identifying the correct (i.e., true) model.

Also, Fan and Sivo, 2005 found the TLI, BL89, RNI, CFI, Gamma, Mc, or RMSEA indices are not more sensitive to misspecified factor loadings than other indices.

## Summary

The goals of this inquiry was determine if the extension of the TAM and SCT into an integrated model, the IP-TAM would provide insight into the perceptions of faculty using the virtual laboratory and specifically determine if the faculty would learn and complete a MPI Simulation using the virtual lab. The inquiry proposes the faculty's self-efficacy for instruction/computers, attitude, personal intuitiveness and system functionality and usefulness were predictors of perceived usefulness and perceived ease of use for the behavioral intention to use the virtual lab. As the need for efficient, effective training and education of health information/informatics professionals increases, the need for a functional and usable instructional technology and information technology model will also expand.

## CHAPTER FOUR: RESULTS

### Introduction

The purpose of this study was to determine if the integrated IP-TAM explains the relationship between faculty members' acceptance of the technology and the variables: Self-Efficacy for Instruction/Computer Self-Efficacy (SEI), Personal Information Technology Innovativeness (PI), System Functionality/Usability (SFU), which are hypothesized to affect Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude (ATT) and Behavioral Intention (BI) which ultimately affects the educational gains of the user. The outcome variable was educational gains (GAINS) as measured by a pretest and posttest of the Master Patient Index (MPI) simulation located on the V-lab web site. Figure 1 depicts the IP-TAM as proposed in this inquiry. The hypothesized IP-TAM model was developed *a priori* and the analysis of the hypothesized model was performed using path analysis.

### Path Analysis of the Hypothesized IP-TAM Model Fit

A Path Analysis was conducted using LISREL 8.80 (Student Edition) and SAS 9.1 on the data from the 137 participants who completed the survey. The results of the path analysis produced a series of fit indices from the sample data. The Normal Theory Weighted Least Squares Chi-Square was equal to 18.61 ( $df = 12, P > .05$ ) and the Mean Square Error of Approximation (RMSEA) was equal to 0.064 for the hypothesized TAM. The Goodness of Fit Index (GFI) was equal to 0.97 with a Comparative Fit Index (CFI) = 0.99, an Incremental Fit Index (IFI) = 0.99, a Relative Fit Index (RFI) = 0.92 and a Standardized RMR = 0.056 all of which indicate a good fit. These values are shown in Table 4 Selected Fit Indices for Both

Models. The CFA Model of the standardized results of the path diagram is shown in Figure 6.

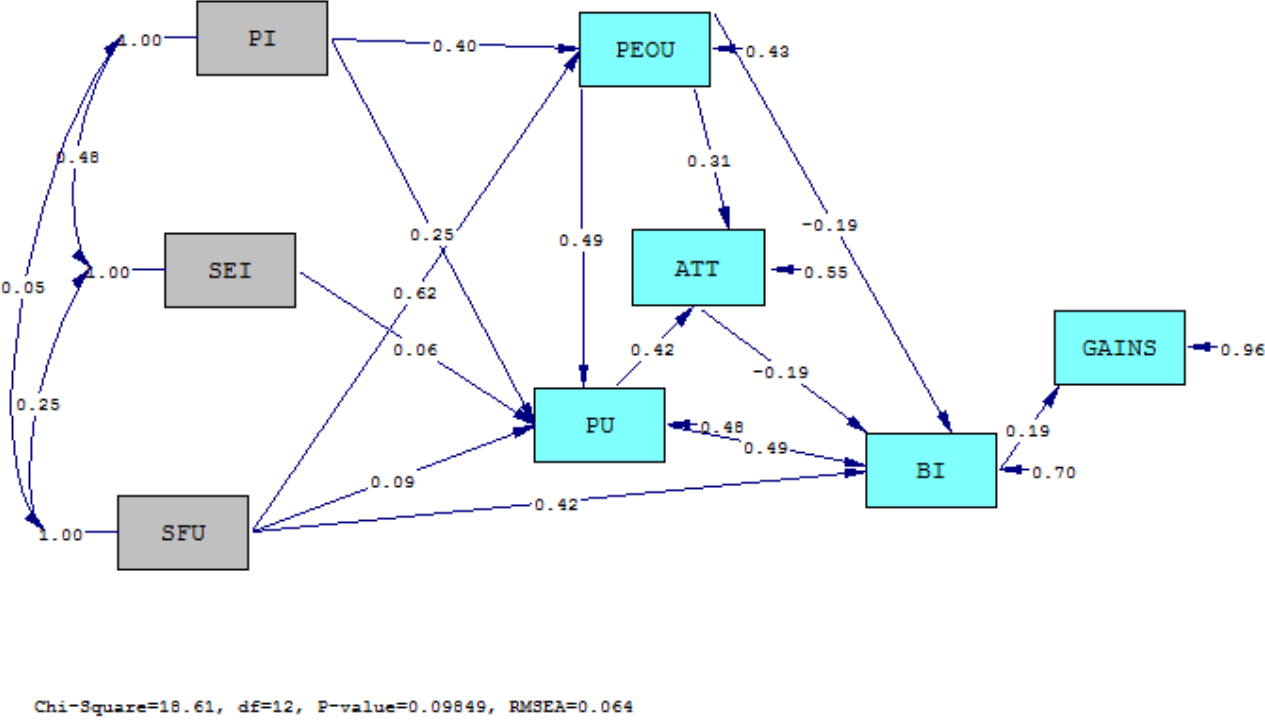


Figure 6 CFA Model of Standardized Estimates of Hypothesized PI-TAM Model

Table 4

## Selected Fit Indices for Both Models

Model	Chi-Square	df	p	NFI	NNFI	CFI	GFI	AGFI	RMSEA	n
Initial Hypothesized Model	18.61	12	0.09849	0.96	0.97	0.99	0.97	0.90	0.064	137
Modified Model	15.52	10	0.11431	0.97	0.97	0.99	0.97	0.90	0.065	137

Note: NFI = Normed fit index; NNFI = Non-Normed Fit Index; CFI = comparative fit index; AGFI = adjusted goodness of fit index; RMSEA = root mean square error of approximation

Table 4

## Selected Fit Indices for Both Models, Continued

Model	Chi-Square	df	p	Std. RMR	PNFI	PGFI	ECVI	n
Initial Hypothesized Model	18.61	12	0.09849	0.056	0.41	0.32	0.50	137
Modified Model	15.52	10	0.11431	0.052	0.35	0.27	0.51	137

Note: Std. RMR=Standardized Root Mean Residual; PNFI=Parsimony Normed Fit Index; PGFI= Parsimony Goodness of Fit Index; ECVI=Expected Cross-validation Index

SFU had the highest factor loading of 0.62 on PEOU. The factor loading analysis revealed that PEOU on PU was one of the highest standardized path coefficients at 0.49 within the Hypothesized IP-TAM structure. PU's standardized path coefficients on BI was also 0.49.

This result concurs with past research findings. The lowest factor loading in within the IP-TAM was PEOU on BI as well as ATT on BI with standardized path coefficient of -0.19 for both. System Functionality and Usability (SFU), a different construct to the TAM, had a standardized path coefficient of 0.42 on BI. Personal innovativeness (PI) had a standardized path coefficient of 0.25 to PU and 0.40 to PEOU. The only trivial path is that of SFU on PU with a 0.09 standardized path coefficient (Hatcher, 1994, p.215).

The analysis revealed R2 values of .0372 for GAINS, .3390 for BI, PEOU .573, and .5190 for PU as shown in Table 6 Hypothesized IP-TAM Path Analysis Manifest Variable Equations (with Standardized Estimates). Table 5 Hypothesized IP-TAM Path Analysis Equations Manifest Variable with Estimates show the t-value of BI was not significant at -1.6403 as was SEI with a t-value of 0.8613 and SFU with a t-value of 1.0829. If a t-value > 1.96 in absolute value, the path is considered significant (Hatcher, 1994, p. 215)

Table 5

Hypothesized IP-TAM Path Analysis Equations Manifest Variable with Estimates

Path to Variable	Path from Variable	Path Coefficient	Std Error (beta)	t-value
GAINS	BI	0.1413	.0616	2.2916*
BI	PEOU	-0.1333	0.813	-1.6403
	PU	0.3338	0.0668	4.9978*
	ATT	-0.1137	0.0450	-2.5271*
PEOU	PI	0.4774	0.0675	7.0750*
	SFU	0.3949	0.355	11.1217*
PU	PEOU	0.5075	0.0942	5.3855*
	PI	0.3133	0.0959	3.2657*
	SEI	0.0660	0.766	0.8613
	SFU	0.0594	0.0549	1.0829
GAINS	BI	0.1413	0.0617	2.2916*

\*t-value > 1.96 in absolute value, therefore the path is significant (Hatcher, 1994, p. 215).



Table 6

Hypothesized IP-TAM Path Analysis Manifest Variable Equations (with Standardized Estimates)

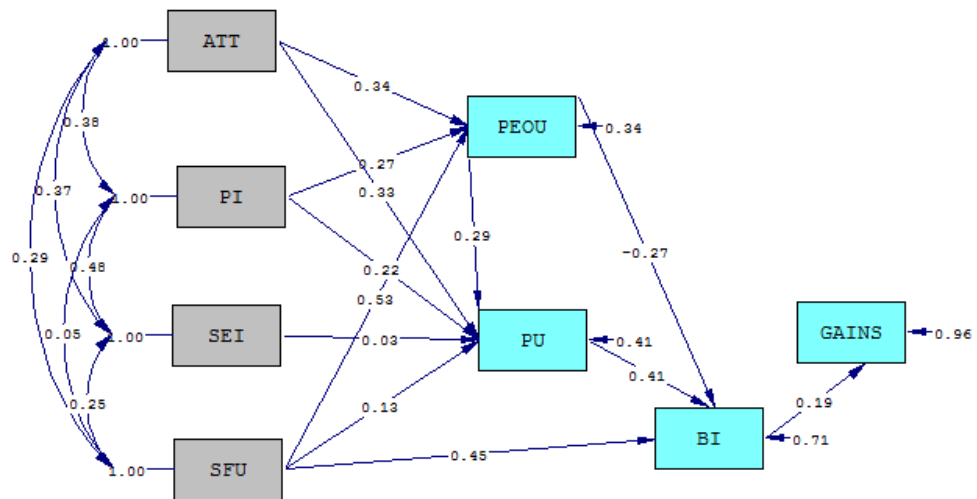
Path to Variable	Path from Variable	Path Coefficient	Error Variance	R <sup>2</sup>
GAINS	BI	.1928	2.25	.0372
BI	PEOU	-0.1841	2.88	.3390
	PU	.4773		
	ATT	-0.1892		
	SFU	.4068		
PEOU	PI	.3969	3.5496	.5731
	SFU	.6240		
PU	PEOU	.4902	4.285	.5190
	PI	.2516		
	SEI	.0604		
	SFU	.0907		

Note: ATT= Attitude, BI=Behavioral Intention, PEOU=Perceived Ease of Use, PI=Personal innovativeness, PU=Perceived Usefulness, SEI=Self efficacy for Instruction/Computers, System Functionality and Usability. Gains=Knowledge Gains. All path coefficients were significant at the  $p > .01$  level. The standardized coefficient are not considered trivial if the value is  $> .05$  (Hatcher 1994, p. 215). (N=137).

#### Path Analysis of the Modified IP-TAM Model Fit

A Path Analysis was conducted using LISREL 8.80 (Student Edition) and SAS 9.1 on the data from the 137 participants who completed the survey. The results of the path analysis produced a

series of fit indices from the sample data. The Normal Theory Weighted Least Squares Chi-Square was equal to 15.86 (df = 10, P > .05) and the Mean Square Error of Approximation (RMSEA) was equal to 0.065 for the hypothesized TAM. The Goodness of Fit Index (GFI) was equal to 0.97 with a Comparative Fit Index (CFI) = 0.99, an Incremental Fit Index (IFI) = 0.99, a Relative Fit Index (RFI) = 0.92 and a Standardized RMR = 0.052 all of which indicate a good fit as shown in Table 3 Selected Fit Indices for Both Models . The CFA Model of the standardized results of the path diagram is shown in Figure 7.



Chi-Square=15.52, df=10, P-value=0.11431, RMSEA=0.065

Figure 7 Path Model of Standardized Estimates of Modified IP-TAM

The factor loading analysis revealed that SFU on PEOU was one of the highest standardized path coefficients at 0.52 within the Hypothesized IP-TAM structure. SFU on BI also had one of the highest standardized path coefficients at 0.45. The lowest factor loading in within the Modified IP-TAM was PEOU on BI, with a standardized path coefficient of -0.27.

Also, low was SEI on PU with standardized path coefficient of 0.03 which is considered trivial (Hatcher, 1994, p. 215). ATT, as an exogenous variable, has standardized coefficients of 0.34 on PEOU and 0.27 on PU.

Table 7

Modified IP-TAM Path Analysis Equations Manifest Variable with Standardized Estimates

Path to Variable	Path from Variable	Path Coefficient	Std Error (beta)	<i>t</i> -value
GAINS	BI	0.1413	0.0630	2.2447*
BI	PEOU	-0.1899	0.0823	-2.3064*
	PU	0.2780	0.0673	4.1284*
	SFU	0.2003	0.0424	4.7232*
PEOU	ATT	0.2818	0.0468	6.0282*
	PI	0.3268	0.0649	5.0326*
	SFU	0.3368	0.0330	10.2102*
PU	PEOU	0.3046	0.0987	3.0864*
	ATT	0.2804	0.0612	4.5784*
	PI	0.2803	0.0881	3.1809*
	SFU	0.0867	0.0510	1.6985
	SEI	0.0285	0.0723	0.3949
GAINS	BI	0.1413	0.0630	2.2447*

\*If the *t*-value > 1.96 in absolute value, therefore the path is significant (Hatcher, 1994, p. 215).

Table 8

Modified IP-TAM Path Analysis Manifest Variable Equations (with Standardized Estimates)

Path to Variable	Path from Variable	Path Coefficient	Error variance	R <sup>2</sup>
GAINS	BI	.1890	2.2543	.0357
BI	PEOU	-0.2677	2.9639	.2914
	PU	.4065		
	SFU	.4462		
PEOU	ATT	.3396	2.2708	.6631
	PI	.2717		
	SFU	.5321		
PU	PEOU	.2936	3.7080	.5855
	ATT	.3257		
	PI	.2246		
	SEI	.0261*		
	SFU	.1320		

\*The standardized coefficient is considered trivial as the value is not >.05 in absolute value (Hatcher, 1994, p. 215)

### Research Question 1

Does the Hypothesized IP-TAM fit the data in predicting the faculty's behavioral intention to use the e-HIM® Virtual Lab?

The R<sup>2</sup> for BI is .3390 or the variable accounts for approximately 34% of the variance

from the variables PEOU, PU, ATT and SFU. The standardized path coefficients are shown in Table 6 for the hypothesized model. The standardized path coefficient of PEOU to BI was -0.1841. The standardized path coefficient of PU to BI is .4773, ATT to BI is -0.1892 and SFU to BI is .4068. The standardized path coefficient from SI to PU is considered trivial at .0261. All other coefficients in the model are not considered trivial (Hatcher, 1994, p. 215).

The Modified IP- IP-TAM s results showed a  $R^2$  of .2914 or variable accounts for approximately 29% of the variance from the variables PEOU, PU and SFU. PEOU shows a  $R^2$  of .6631 or explains approximately 66% of the variance from the variables ATT, PI and SFU. PU has an  $R^2$  of .5855 or explains approximately 59% of the variance from the variables PEOU, ATT, PI, SEI and SFU.

### Research Question 2

To what extent does Personal Information Technology Innovativeness (PI) and System Functionality/Usability (SFU) impact the Hypothesized IP-TAM and Modified IP-TAM?

The variable PI has a standardized coefficient of .3969 to PEOU and a standardized coefficient of 0.2516 to PU in the Hypothesized IP-TAM. In the Modified IP-TAM, the standardized coefficient of .2717 for PI to PEOU and a standardized coefficient of .2246 to PU in the modified model contributes positively to the model. PU has a  $R^2$  of .5855 in the modified model and accounts for almost 59% of the variance for that variable in the modified model.

### Research Question 3

Is the HIM faculty's attitude and behavioral intentions to use the e-HIM® Virtual Lab's MPI Simulation determined by the Self-Efficacy for Instruction/Computer Self-Efficacy (SEI)?

The variable SEI has a standardized coefficient of 0.0604 to PU in the hypothesized IP-TAM. The variable SEI has a standardized coefficient of 0.0261 to PU in the modified IP-TAM and is considered trivial. SEI does not appear to contribute significantly to the overall model.

#### Research Question 4

To what extent does the MPI Simulation teach the desired concepts? Do the participants show knowledge gains evidenced by pretest and to posttest scores?

Using SPSS v. 15.0, a General Linear Model Repeated Measure ANOVA was the statistical procedure performed to evaluate knowledge gains from the pretest and posttest questions. The knowledge gains were evaluated using three different groupings of the participants: (1) Full Time and Part Time Work status, (2) Age Groups and (3) Faculty Status. Gender was not used as a grouping variable because only 5.9% (n=10) of those participants answering the gender question were male. Additionally over 12% (n= 25) of the participants declined to answer the question or were missing as shown in table 8. The number of males answering the questions thought was thought to be insufficient for a meaningful analysis.

Table 9

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	10	5.2	5.9	5.9
	Female	159	82.0	94.1	100.0
	Total	169	87.1	100.0	
Missing	System	25	12.9		
Total		194	100.0		

Knowledge gains were measured using 6 questions for the pretest and posttest. The

pretest and posttest questions are located in Appendix A – Survey Instruments. The knowledge competency questions were developed by the author.

The first procedure performed used the groupings of self selected work status as full-time or part-time faculty participants. A review of Box’s test for Equality of Covariance Matrices revealed that the covariance matrices of the groups were not different to a statistically significant degree, so sphericity may be assumed (see Table 10).

Table 10

Box's Test of Equality of Covariance Matrices(a) Work Status Full Time and Part Time Groups

Box's M	2.720
F	.435
df1	6
df2	18477.582
Sig.	.856

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.  
a. Design: Intercept+FTPTRecode  
Within Subjects Design: time

To determine whether the faculty demonstrated an increase in their knowledge regarding the MPI Simulation, the focus of the analysis is placed on the interaction between Age Groups and the Pretest and Posttest, i.e., time. A review of this result reveals that a there was not statistically interaction between work status and pretest and posttest,  $F(1, 163) = 2.534, P > 0.05$  (See Table 11 Full Time or Part Time Work Status Pretest/Posttest Results).

Table 11

Full Time or Part Time Work Status Group Pretest/Posttest ANOVA Results

Tests of Within-Subjects Contrasts

Measure: MEASURE\_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Linear	40.388	1	40.388	31.133	.000	.160
time * FTPTRecode	Linear	6.574	2	3.287	2.534	.082	.030
Error(time)	Linear	211.450	163	1.297			

a. Computed using alpha = .05

Table 12

Descriptive Statistics for Full time-Part time Group Repeated Measures ANOVA

	FTPTRecode	Mean	Std. Deviation	N
PRE_TOTL	Full Time	3.21	1.412	127
	Part Time	3.50	1.439	22
	No teaching	3.18	1.468	17
	Total	3.25	1.416	166
PST_TOTL	Full Time	4.40	1.323	127
	Part Time	3.91	1.231	22
	No teaching	4.59	1.064	17
	Total	4.36	1.293	166

The change that did occur in the means is numerically depicted in Table 12 Descriptive Statistics for Full time- Part time repeated measures ANOVA.

The second procedure utilizing the Pretest-Posttest results were evaluated using a Repeated Measures ANOVA using Age Groupings.



Table 13

Box's Test of Equality of Covariance Matrices(a) Age Group Pretest/Posttest ANOVA Results

Box's M	9.868
F	1.055
df1	9
df2	12757.914
Sig.	.393

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.  
 a Design: Intercept+Age\_Rec  
 Within Subjects Design: time

A review of Box’s test for equality of covariances (Table 13) revealed that the covariance matrices of the groups were not different to a statistically significant degree, so sphericity may be assumed.

Table 14

Age Group Pretest/Posttest ANOVA Results

Tests of Within-Subjects Contrasts

Measure: MEASURE\_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Linear	49.285	1	49.285	37.212	.000	.190
time * Age_Rec	Linear	5.648	3	1.883	1.422	.239	.026
Error(time)	Linear	210.585	159	1.324			

a Computed using alpha = .05

To determine whether the faculty demonstrated an increase in their knowledge regarding the MPI Simulation, the focus of the analysis is placed on the interaction between fulltime and part time work status. A review of this result reveals that a there was not statistically significant interaction between work status and pretest and posttest,  $F(1, 159) = 1.422, P > 0.05$  (See Table

14 Age Group Pretest/Posttest ANOVA Results).

Table 15

Descriptive Statistics for Age Groups Repeated Measures ANOVA

	AgeGroupRecode	Mean	Std. Deviation	N
PRE_TOTL	18-39	3.32	1.416	28
	40-49	3.26	1.534	53
	50-59	3.16	1.441	70
	60+	3.33	1.155	12
	Total	3.23	1.438	163
PST_TOTL	18-39	4.11	1.449	28
	40-49	4.57	1.233	53
	50-59	4.44	1.187	70
	60+	3.83	1.467	12
	Total	4.38	1.278	163

The pretest means were roughly equal in value and the posttest mean for the group somewhat higher, though not statistically significantly higher (see Table 15 Descriptive Statistics for Age Groups Repeated Measures ANOVA).

To determine whether the faculty demonstrated an increase in their knowledge regarding the MPI Simulation, the third procedure focused of the analysis on the interaction between Faculty Rank(FR). A review of Box's test for equality of covariances (Table 16) revealed that the covariance matrices of the groups were not different to a statistically significant degree, so sphericity may be assumed.

Table 16

Box's Test of Equality of Covariance Matrices(a) for Faculty Rank Groups

Box's M	23.797
F	1.487
df1	15
df2	8067.304
Sig.	.100

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept+WS

Within Subjects Design: time

To determine whether the faculty demonstrated an increase in their knowledge regarding the MPI Simulation, the focus of the analysis is placed on the interaction between Faculty Rank (FR) and the Pretest and Posttest, i.e., time. A review of this result reveals that a there was a statistically interaction between work status and pretest and posttest,  $F_{1, 162} = 2.650$ ,  $P < 0.05$  (See Table XX Faculty Work Status Pretest/Posttest ANOVA Results). Almost 8.9% of the variance in score can be accounted for by the group differences in the pretest and posttest scores.

Table 17

Faculty Rank Pretest/Posttest ANOVA Results

Tests of Within-Subjects Contrasts

Measure: MEASURE\_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Linear	38.142	1	38.142	30.977	.000	.161
time * FR	Linear	19.574	6	3.262	2.650	.018	.089
Error(time)	Linear	199.467	162	1.231			

a. Computed using alpha = .05

There is a statistically significant difference between pretest ( $M = 3.25$ ,  $s = 1.413$ ) and posttest ( $M = 4.36$ ,  $s = 1.288$ ) scores ( $F_{1, 162} = 30.977$ ,  $P < .05$ ). Almost 16% of the variance in

the score can be attributed by time. The means for the pretest scores and the posttest scores (time 1 and 2) are taken from Table 18 Faculty Rank Means for Pretest (time 1) and Posttest (time2).

Table 18

Faculty Rank Tests of Within-Subjects Effects

Measure: MEASURE\_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	38.142	1	38.142	30.977	.000	.161
	Greenhouse-Geisser	38.142	1.000	38.142	30.977	.000	.161
	Huynh-Feldt	38.142	1.000	38.142	30.977	.000	.161
	Lower-bound	38.142	1.000	38.142	30.977	.000	.161
time * FR	Sphericity Assumed	19.574	6	3.262	2.650	.018	.089
	Greenhouse-Geisser	19.574	6.000	3.262	2.650	.018	.089
	Huynh-Feldt	19.574	6.000	3.262	2.650	.018	.089
	Lower-bound	19.574	6.000	3.262	2.650	.018	.089
Error(time)	Sphericity Assumed	199.467	162	1.231			
	Greenhouse-Geisser	199.467	162.000	1.231			
	Huynh-Feldt	199.467	162.000	1.231			
	Lower-bound	199.467	162.000	1.231			

a. Computed using alpha = .05

Table 19

Faculty Work Status Means for Pretest (time 1) and Posttest (time2)

Measure: MEASURE\_1

time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	3.346	.161	3.028	3.665
2	4.343	.145	4.057	4.629

There is not a statistically significant interaction effect ( $F_{6,162}=.670, p>.05$ ) as shown in

Table 20 Test of Between Subject Effects.

Table 20

Tests of Between-Subjects Effects for Faculty Rank

Measure: MEASURE\_1  
Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	2270.723	1	2270.723	953.865	.000	.855
FR	9.570	6	1.595	.670	.674	.024
Error	385.649	162	2.381			

a. Computed using alpha = .05

Table 21

Descriptive Statistics for Faculty Rank Repeated Measures ANOVA

	WS	Mean	Std. Deviation	N
PRE_TOTL	ProgDir	3.20	1.469	82
	Prof	4.25	.957	4
	Assoc	3.00	1.512	8
	Assist	3.52	1.312	27
	Instructor	2.79	1.357	19
	Adjunct	3.45	1.468	20
	Other	3.22	1.202	9
	Total	3.25	1.413	169
PST_TOTL	ProgDir	4.54	1.135	82
	Prof	5.00	.000	4
	Assoc	4.25	1.982	8
	Assist	4.11	1.601	27
	Instructor	4.63	1.257	19
	Adjunct	3.65	1.137	20
	Other	4.22	1.093	9
	Total	4.36	1.288	169

To insure that the change that did occur was in the predicted direction with the pretest means being roughly equal in value and the posttest mean for the group somewhat higher and were statistically significant ( see Table XX Descriptive Statistics for Work Status Repeated

Measures ANOVA). However, there were small groups of participants in the Professor category (n= 4), the Associate Processor category (n=8) and the Other Category (n=9) that the analysis, while being statistically significant, may not be applicable in some situations.

The plotted means shown in Figure 8 demonstrate visually what is seen numerically above.

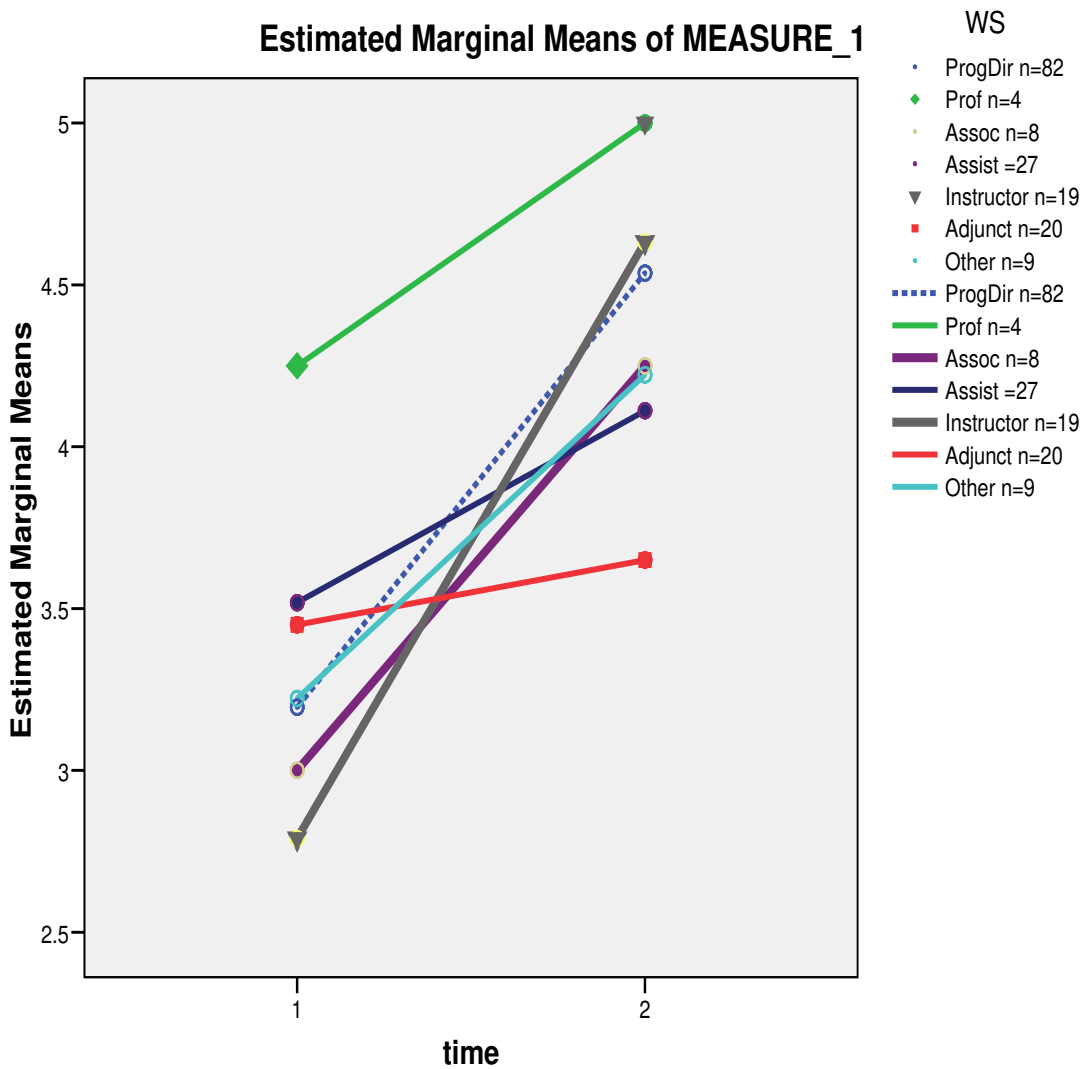


Figure 8 Plotted Means for Faculty Rank Repeated Measures ANOVA

## Data Characteristics

Participation in the study was on a voluntary basis and names and email addresses were kept in a locked file per IRB agreement. The UCF-IRB approved the study and the documentation is contained in Appendix D: IRB Documents.

Initial contact email letters were sent to 255 HIM program contact as listed on the CAHIIM website. Another 195 initial individual contacts letters were sent either from the contact from the initial contact or from the various academic institutional websites. A total of 450 initial contacts were made and there were 195 entries into the survey. The 195 survey respondents was divided by 450 the number of initial contacts to yield a 43.3% response rate. Of the 195 respondent entries into the survey, 176 respondents completed the survey for a 90% completion rate. Table 22 E-Mail response Statistics has a breakdown of the contact made when sending out the survey. There were 1,351 total email contacts for the entire survey. Survey respondents receive an initial contact letter, first follow-up letter, second follow-up letter and thank you letter, if appropriate. The initial letters, first and second follow-up letters as approved by the UCF-IRB are contained in Appendix B: Consent Letter E-mail Documents.

Listwise deletion by SPSS v.15.0 was used for determination of valid cases for all statistical procedures. The correlation matrix was formed using SPSS v. 15.0.

Table 22

E-mail Response Statistics

Type of Program	Total Number Programs	Number of Programs Contacted	Initial Letters sent	Initial Letters to individual faculty	Thank You Letters Sent	Follow-up letters	Total email Letters
<b>Masters approved Programs (Duplicated in HIA Programs)</b>	<b>3</b>	<b>3</b>	0*	0	0	0	<b>0</b>
Baccalaureate Program CAHIIM Accredited	47						
School Programs in Candidacy	4						
<b>HIA- Total</b>	<b>51</b>	<b>41</b>	48	64	36	211	<b>400</b>
Associate Degree Schools CAHIIM Accredited	197						
Associate Degree School Programs in Candidacy	19						
<b>HIT Total</b>	<b>216</b>	<b>177</b>	189	103	54	393	<b>739</b>
Approved Coding Certificate Programs	34	28	18**		3	85	<b>106</b>
Undeliverable address or Program closed or refused.			2	3			
<b>Grand Total</b>	<b>304</b>	<b>249</b>	<b>255</b>	<b>195</b>	<b>93</b>	<b>689</b>	<b>1351</b>

\*\* Duplicates with Dual HIT and Coding Programs = 16



### *Reliability*

Seven scales were used to measure attitude (ATT), behavioral intention (BI), perceived ease of use (PEOU), personal innovativeness (PI), perceived usefulness (PU), self efficacy for instruction and computers (SEI), system functionality and usability (SFU), Gains were measured using the pretest and posttest items. An internal reliability testing for the scales was examined using SPSS v. 15.0 for Windows. Table XX shows the results of the reliability testing and the number of items for each scale. Cronbach Alpha Coefficients exceeding .80 were deemed satisfactory for the scores obtained on all seven measures.

Table 23

#### Internal Consistency Reliability Coefficients

Cronbach Alpha for Scores on Instruments		
Instrument	Number of Items	Cronbach Alpha
Attitude (ATT)	7	.726
Behavioral intention (BI)	2	*
Perceived ease of use (PEOU)	6	.695
Personal innovativeness (PI)	4	.724
Perceived usefulness (PU)	6	.731
Self efficacy for instruction and computers (SEI)	8	.815
System functionality and usability (SFU)	8	.931

\*It is not appropriate to conduct a Reliability Analysis on two items

The Cronbach Alpha Coefficients exceeded .695 and were deemed satisfactory for scores obtained on all seven measures.

Table 24

Frequency and Intensity of Variables

Variable	N		Mean	SD	Sum	Minimum	Maximum
	Valid	Missing					
ATT	185	9	28.77	5323	4.105	8	35
BI	167	27	7.62	1272	2.243	0	12
PEOU	152	42	25.27	3841	3.337	9	30
PI	184	10	16.81	3093	2.584	4	20
PU	158	36	25.96	4101	3.264	9	30
SEI	178	16	36.11	6427	3.613	8	40
SFU	165	29	28.04	4627	5.997	0	35
GAINS	194	0	.67	130	1.978	-5	6

SD= Standard Deviation

Demographics

The Health Information Management Association currently has 51,000 members AHIMA, (2008). The membership of AHIMA is approximately 95% female (AHIMA, 2002). The gender demographics for faculty responding to the survey were somewhat more diverse with 94.1% of those responding to the survey question about gender had marked “female” (See Table 9).

Of those responding to the survey question about Ethnicity, approximately 85% selected Caucasian, 8% selected African-American, 2.5 each for Hispanic, Pacific Islander and Other (see Table 25).

Table 25

Ethnicity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Caucasian	138	71.1	84.7	84.7
	African-American	13	6.7	8.0	92.6
	Hispanic	4	2.1	2.5	95.1
	Pacific Islander	4	2.1	2.5	97.5
	Other	4	2.1	2.5	100.0
	Total	163	84.0	100.0	
Missing	System	31	16.0		
Total		194	100.0		

The faculty rank of the respondents found 82 respondents or 42.3 % of faculty was program directors as shown in Table 26. Assistant professors were 13.9% of respondents with adjunct instructor at 10.9% of respondents. The lower levels of adjunct faculty are not comparable with the demographic of great than 62% adjunct faculty employed by HIM programs as reported by AHIMA (September 24, 2007).

Full time faculty responding to the survey were the majority of respondents or 65.5%. Part-time faculty responded as part- time faculty as shown in table 27. Interestingly, 14.4 percent of respondents did not answer the question concerning full or part-time status.

Table 26

Faculty Rank

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Program Director	82	42.3	48.5	48.5
	Prof	4	2.1	2.4	50.9
	Assoc	8	4.1	4.7	55.6
	Assist	27	13.9	16.0	71.6
	Instructor	19	9.8	11.2	82.8
	Adjunct	20	10.3	11.8	94.7
	Other	9	4.6	5.3	100.0
	Total	169	87.1	100.0	
	Missing System	25	12.9		
Total	194	100.0			

Table 27

Full Time - Part Time Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Full Time	127	65.5	76.5	76.5
	Part Time	22	11.3	13.3	89.8
	No teaching	17	8.8	10.2	100.0
	Total	166	85.6	100.0	
Missing System	28	14.4			
Total	194	100.0			

Summary

The IP-TAM in this inquiry focuses on the relationships among the constructs of Perceived Usefulness, Perceived Ease of Use, Attitude, Behavioral Intention and Knowledge Gains in the hypothesized IP-TAM. In the Modified IP-TAM the Attitude construct is moved to being an exogenous variable and provide a somewhat better fitting model for this particular group, HIM Faculty, using this particular technology, the E-him Virtual Lab. The TAM and SCT

were combined to include personal innovativeness for information technology, self-efficacy for instruction and computers, system functionality and usability. The outcome variable was knowledge gains measured by the pretest posttest taken by the faculty around the MPI Simulation on the virtual lab.

A path analysis was conducted on the scale level. The seven scales were adapted to measure the constructs using a five point Likert scale. Fall semester 2007 was the time period used for data collection (n=195). The results of the hypothesized model demonstrated a goodness of fit based on various model fit scales: the Normal Theory Weighted Least Squares Chi-Square was equal to 18.61 (df = 12, P > .05) and the Mean Square Error of Approximation (RMSEA) was equal to 0.064 for the hypothesized TAM. The Goodness of Fit Index (GFI) was equal to 0.97 with a Comparative Fit Index (CFI) = 0.99, an Incremental Fit Index (IFI) = 0.99, a Relative Fit Index (RFI) = 0.92 and a Standardized RMR = 0.056. The modified IP-TAM also demonstrated a slightly better fit based on the various model fit scales: the Normal Theory Weighted Least Squares Chi-Square was equal to 15.86 (df = 10, P > .05) and the Mean Square Error of Approximation (RMSEA) was equal to 0.065 for the hypothesized TAM. The Goodness of Fit Index (GFI) was equal to 0.97 with a Comparative Fit Index (CFI) = 0.99, an Incremental Fit Index (IFI) = 0.99, a Relative Fit Index (RFI) = 0.92 and a Standardized RMR = 0.052. The outcome variable of knowledge gains did not have a large effect size.

## CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

For this particular group of people, HIM Faculty, viewing the MPI simulation, the initial Hypothesized IP-TAM fit the data and Modified IP-TAM fit the data well. The contribution of GAINS to the overall model fit appeared to have little impact with a  $R^2$  of 0.036 or accounting for approximately 3.6% of the variance in the modified IP-TAM. Jacob Cohen, states that if generally the R Square falls below .09, the effect size is considered to be small. The highly significant findings occurred with the variables PU, PEOU, BI with  $R^2$  of 0.5190, 0.5731 and 0.3390 respectively, or 51.90%, 57.31% and 33.90% of the variance explained by the variable. Jacob Cohen, states that if generally the R Square falls between .09 to .24 is considered a medium effect size and over .25 is considered a large effect size (1977, p. 80). Clearly, the variables BI, PU and PEOU for this group, HIM Faculty, are considered to be a large effect size.

The variable PI contributed to the model with a standardized coefficient of .2717 to PEOU and .2246 to PU in the Modified IP-TAM. Similarly, in the Hypothesized IP-TAM, the variable, PI had a standardized coefficient of .3969 to PEOU and .2516 to PU.

The variable SFU contributed to the Modified IP-TAM model with a standardized coefficient of .4462 to PEOU and .5321 to PU in the Modified IP-TAM. Similarly, in the Hypothesized IP-TAM, the variable, PI had a standardized coefficient of .6240 to PEOU and .0907 to PU.

The variable ATT, as an exogenous variable, in the Modified IP-TAM Path contributed a standardized coefficient of .3396 to PEOU and .3257 to PU. In the hypothesized IP-TAM

model, the endogenous variable ATT had a standardized coefficient of -0.1892 to BI. Following the recommendation of Sun and Zhang (2006)'s meta analysis, the ATT variable was moved to an exogenous variable in the modified IP-TAM where it appeared to influence the model more positively. The faculty's perception in this study appear to indicate the perception of SFU and PU, PEOU were the factors indicating if they would use the V-lab again in the future.

In this empirical study, the faculty behavioral intention (GAINS and BI) to use the V-lab was predicted by the variables PEOU, PU and SFU ( $P > .05$ ). SEI did not contribute significantly to the model. Personal innovativeness (PI) and the perceptions as to system functionality and usability (SFU) did contribute significantly to both the Hypothesized and Modified IP-TAM models.

The outcome variable, GAINS, was significant when faculty academic status was considered. However, the small sample sizes of several faculty categories put the practical significance of this finding into question. As a basic function, the MPI simulation would not likely be expected to have a significant finding for knowledge GAINS for faculty because the Master Patient Index is considered to be one of the very basic applications of the V-lab (Kersten, 2007). The statistical significance, while minor, has a practical implication for future research and instructional design of the V-lab: as the MPI is considered to be a basic application, one cannot assume the faculty have knowledge of the applications being portrayed in the V-lab lessons.

A recent methodological review of current information technology literature as it impacts health care was published in 2007 by Kukafka, Johnson, Linfantes and Allegrante (2007) who proposed the following: there is no "single bullet" (p. 227) theory for solving disparate healthcare user IT problems. Kukafka et al. (2007) developed a framework utilizing a behavioral

science viewpoint which proposes multi-level use of theory in light of characterization of IT problems and empirical evidence. Sun and Zhang (2006) meta analysis also found that individual and contextual factors should be considered in predicting user acceptance. HIM faculty are in a fairly unique situation with the external influences urging teaching an ever increasingly diverse student body how to manage in a ever more complex world rushing to embrace multiple complex software applications, particularly health information technologies leading to Electronic Health Records (EHR) and other applications promoting patient-centric care(AHIMA, September 24, 2007). The role of the HIM faculty is multifaceted and expanding. The variable of personal innovativeness embraces the possible prediction of faculty who may be especially disposed to embracing new instructional technologies and informational technologies.

A modified IP-TAM model was developed following analysis of recent literature and review of the correlation matrix which for this particular group of people viewing this particular MPI simulation that attitude appears to correlate more directly as an independent variable rather than a dependent variable. The results of the Path Analysis also show that SEI did not appear to contribute significantly to the overall model for either the hypothesized or modified model. SFU did appear to contribute significantly to the overall model in both versions of the model. The modified IP-TAM is shown in Figure 10.



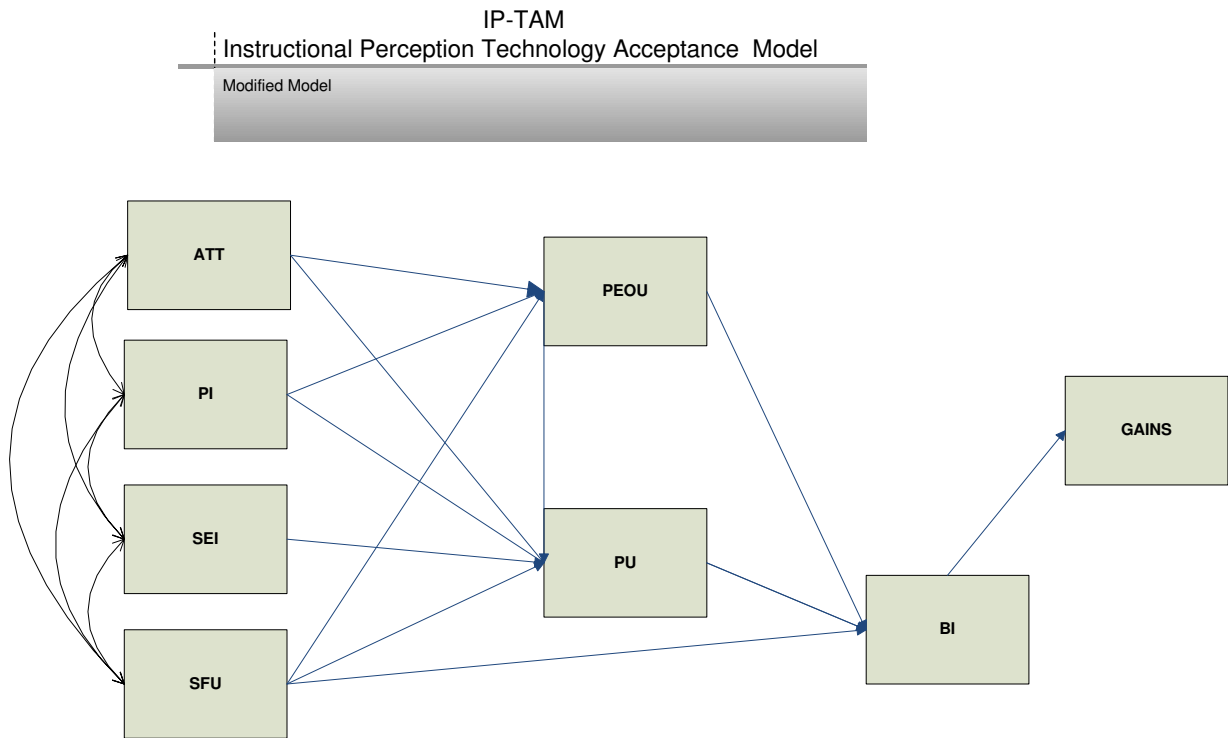


Figure 9 Modified IP-TAM

### Limitations

This research inquiry is a single study of 137 faculty participants using only the sample portion of the MPI Simulation portion of the e-HIM<sup>®</sup> Virtual Lab during one semester. The results are limited in their generalizability in that the e-HIM<sup>®</sup> Virtual Lab, as there several other software applications housed on the virtual laboratory. The faculty in this inquiry were specific to the Health Information Management and health informatics profession.

Other limitations of the study are:

1. A self reported study may not fully portray the faculty acceptance of the instructional technology due to the imperfections of the formative research design.

2. The validity of the study depends upon the honesty of the participant answers to the questions.
3. The sample population in the study was nonrandomized. In order to obtain an adequate sample size, more schools were contacted than initially planned, and as a result the population was not randomized. Inclusion of fewer program directors in additional research may produce a different result.
4. It is possible that only those faculty who are disposed to being innovative responded to the survey.
5. An area of concern is the simplicity and small size of the MPI Simulation as offered as a free preview to the V-lab. These results may not be indicative of faculty technology acceptance of the more complicated software applications contained within the V-lab.

#### Recommendations for Further Study

In the process of study formulation, the existing applications were found to be incomplete and not user friendly from an instructional design standpoint. Access for non-subscribers was problematic and the V-lab staff were not able to accommodate non-subscribers as temporary users, therefore the sample MPI simulation was used for this study.

No complete list of the total HIM faculty population was available for randomized study, therefore a randomized study of all HIM faculty users is recommended, so that findings may be generalized to this population.

Further study is needed to evaluate the usability of the V-lab and its software applications as they exist in the password protected V-lab. Specifically, further research is suggested to see if the SFU and PI variables are generalizable across other applications in the virtual lab.

Longitudinal research, if appropriate, may be indicated for faculty and students using the full MPI application as well as other applications of the virtual lab in a true experimental design. Knowledge gains may not be a viable variable for faculty over time. The use of a continuance variable (Smith, 2006) has been used in other longitudinal research for teachers with the TAM and has shown initial positive results and may be more indicative of long term use of a virtual lab over time.

Other research, which may be indicated, could include longitudinal research of the perceptions of other health professions and students who use virtual laboratories. Longitudinal research of students and faculty using the virtual laboratory may provide additional evidence as to the role of attitude, system functionality and usability, personal innovativeness and self efficacy. Incorporation of a variable for continuance intention could be explored to see if the findings of this inquiry can be verified over the course of a semester or longer. Further, the need for expansion of variable

Further research of faculty and students using virtual laboratories is important for advancing the knowledge about perceptions and actual use of virtual laboratories as a useful, efficient and cost effective teaching technology. Use of information technology simulations and instructional technology is thought to be pivotal for training the students and faculty of the future. However, unless knowledge and perceptions are evaluated, the research and development investment costs, acquisition, installation and use of both instructional technology and information technologies including virtual labs may be prohibitive. Clearly, using models such as the IP-TAM may be one method for predicting use and cost effective expenditures on instructional tools for faculty and students. As the complexities of the workplace for the health information and informatics professionals expand into increasingly complex electronic health

records, integrated knowledge based systems for patient-centric care in the twenty-first century will be modesl such as the IP-TAM will be more important than ever.

Caution should be employed when offering complicated software applications to faculty who may or may not understand the application's use. The faculty may not be competent and confident using the new applications, indicating further research in these areas is indicated.

### Recommendations

AHIMA may want to expand dissemination of information about the V-lab system to faculty to promote use. Anecdotally, faculty reported not knowing about the V-lab and its capabilities. The subscription fee is clearly prohibitive to many institutions as evidenced by the lack of participating schools. If the subscription fee is continued, perhaps the monies could be used for providing onsite training to the faculty. Training for the password protected virtual lab applications was inadequate and time consuming. Clearly, it was shown that inadequate training decreased usage of the V-lab.

Collaboration with multiple faculty and instructional designers in formulation of the V-lab system is essential. Effective and efficient training should be required. Instructional design of training may streamline and utilized newer training technologies which may be more effective.

Prior to any implementation of any application, faculty must receive formal training on the applications.

## **APPENDIX A: SURVEY INSTRUMENTS**

## PERSPECTIVES OF HIM FACULTY USE OF AN E- LEARNING LAB &

### 1. Welcome

## "PERSPECTIVES OF HEALTH INFORMATION MANAGEMENT FACULTY USE OF AN E- LEARNING LAB AND TECHNOLOGY ACCEPTANCE QUESTIONNAIRE"

### A few important notes about your participation:

1. Your answers are completely confidential and will be released only as aggregates or summaries.
2. This survey is voluntary.
3. All electronic data will be kept on a password protected external hard drive. Any paper documents will be kept in a locked file accessible only to the researcher.
4. **YOU MUST BE 18 YEARS OF AGE OR OLDER TO PARTICIPATE.**
5. Any compensation or other direct benefits to you as a participant in this study are not provided by the researcher. There are no anticipated risks.
6. You are free to withdraw your consent to participate and may discontinue your participation in the survey at any time without consequences. **THE SURVEY WILL NOT BE LINKED TO YOUR EMAIL ACCOUNT OR YOUR INTERNET BROWSER.**
7. **THIS SURVEY USES "SECURE SOCKETS LAYER (SSL)" WHICH IS USED FOR TRANSMITTING INFORMATION PRIVATELY OVER THE INTERNET.** Many corporations and academic institutions require SSL when collecting data.
8. Research at the University of Central Florida is conducted under the oversight of the UCF Institutional Review Board. Questions or concerns about research participants' rights may be directed to the UCF IRB Office, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246. The telephone number is 407-823-2901. The hours of operation are 8:00 am until 5:00 pm, Monday through Friday except on University of Central Florida official holidays.
9. Thank you very much for your time to complete this important survey.
10. If you have any questions about this research project, please contact me at 800-938-3840 or 407-463-3579 or my faculty supervisor, Dr. Sivo at 407-823-4147.

## PERSPECTIVES OF HIM FACULTY USE OF AN E- LEARNING LAB &

You do not have to answer any questions and you may discontinue the survey at any time.

There are approximately **67** multiple choice questions in this survey.

**Thank you for your participation!**

Peggy L. Meli, MS, RHIA, LHRM  
PhD Candidate in Instructional Technology  
Educational Research, Technology, and Leadership, College of Education at the  
University of Central Florida

Cell 407-463-3579

University of Central Florida



**PERSPECTIVES OF HIM FACULTY USE OF AN E- LEARNING LAB &**

**Please complete or mark the response below that best describes you or your usual instructional approach and preferences.**

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	Not Applicable
1. I take care to craft good assessments and questions for students.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I provide challenges for capable students.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I use a variety of assessment strategies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I attempt to gauge student comprehension.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I often look for opportunities to develop new skills and knowledge to use with teaching.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I enjoy challenging and difficult tasks where I learn new skills.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. For me, developing new teaching skills or work capabilities is important enough to take risks.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I prefer to work in situation that requires a high level of ability and talent.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I use personal computers for work and play	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



**PERSPECTIVES OF HIM FACULTY USE OF AN E- LEARNING LAB &**

10. I am comfortable using HIM software applications on the computer.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. I think that using computers improves the quality of teaching that I do.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. I interact with students in one or more of the following ways: course management system, email, discussion boards or on the internet/web.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. I encourage students to interact with classmates through the internet/web.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. I feel comfortable using computers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. Computers make learning easier and more efficient.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. I prefer to deliver lessons using computers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. My students expect me to use computers for instruction.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. Many people in my college or university use computers for instructional purposes.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. Overall the	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**PERSPECTIVES OF HIM FACULTY USE OF AN E- LEARNING LAB &**

university or college administration feels that computers are important for instructional purposes.						
20. My colleagues share information and ideas about computer use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. The use of email gives me easier access to colleagues, administration and students.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. Using computers increases my workload.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. Using Course Management System such as WebCT, Blackboard or Moodle increases my workload.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. Using the e-HIM@ Virtual lab would or does increase my workload.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. Overall, I find it is easy for me to become skillful at using computers or web-based Instructional Technology.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. I like to experiment with new information technologies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27. Among my peers, I am usually the first to try out	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## PERSPECTIVES OF HIM FACULTY USE OF AN E- LEARNING LAB &

new information technologies.

28. I like to use computers and/or web-based instructional technology for instruction.

29. The computers and/or web-based instructional technology or technologies are fun to use.

30. The Internet or web-based instructional technology or technologies are easy to use.

31. I am not intimidated by using e-learning based courses.

32. I learn best by absorption (sit still and absorb).

33. I learn best by construction (by participation and contribution).

The next few questions are a Pretest about the Master Patient Index. After you complete the questions, you will be able to view a Master Patient Index (MPI) Simulation. The Survey concludes with a repeat of these six questions and few more questions about you and your ratings of the MPI Simulation.

34. Many healthcare organizations use the following to help resolve patient duplicates in the master patient index:

- Drivers license photos
- Patient birth dates
- Finger Prints
- Address verification software

**PERSPECTIVES OF HIM FACULTY USE OF AN E- LEARNING LAB &**

**35. When trying to match duplicates in a master patient index, a source which may be used for confirmatory information is:**

- Signatures pages in the patient medical record
- Your personal knowledge of patient financial services policies
- The master patient index entries themselves
- The spelling of the first and last names

**36. When merging of duplicate records, the organization policies**

- Define the MPI spelling rules
- Never explain the purpose of survivor and retiree records
- Always choose the oldest MPI number
- Dictate the requirements for merging records

**37. The MPI Simulation indicates that organizational policies will:**

- Always choose the newest address as the most correct address
- Always use address verification software
- Define the role of source and administrative records in merging MPI entries
- None of the above.

**38. Duplicate records in the master patient index may cause:**

- Increased administrative and clinical costs
- Adverse impact on quality documentation in the patient medical record or information
- Inability for the organization to provide cost-effective quality care
- All of the above

**39. Potential sources of verification information for master patient index entries include all of the following except:**

- Other databases that may include social security information
- Signatures pages
- DNA and Finger prints
- Copies of identification cards filed in other records

### Visiting the e-HIM Virtual Lab MPI Simulation

This portion of the Survey takes about 10 minutes to complete.

- 1) Keep this survey OPEN
- 2) View the AHIMA e-HIM Virtual Lab MPI Simulation.

[Click here to open the MPI Simulation](#)

The Master Patient Index (MPI) Simulation is a demonstration of Merging Records in an MPI using the Quadra®-Med Smart Merge® Software.

3) There are Playback Controls on the bottom of the screen which look like a DVD or VCR player control buttons. There are also step by step instructions on the screen.

4) After completing the MPI Simulation,

Please return to this survey to complete the last few multiple choice questions.

THE SURVEY CONTINUES BELOW



Please return to this survey to complete the last few multiple choice questions.

THE SURVEY CONTINUES ON THE NEXT PAGE



**More Information**

We hope you enjoyed this exercise. If you would like to learn more about AHIMA's e-HIM Virtual Lab, please visit our Web site at:

<http://campus.ahima.org/vlab>

## 2. Final portion of the Survey

### CONTINUE HERE

**Note:** The next six questions are a repeat of the questions you took before viewing the MPI Simulation. Please answer them with the knowledge you may have gained by viewing the simulation. Many Thanks!

**40. Many healthcare organizations use the following to help resolve patient duplicates in the master patient index:**

- Drivers license photos
- Patient birth dates
- Finger Prints
- Address verification software

**41. When trying to match duplicates in a master patient index, a source which may be used for confirmatory information is:**

- Signatures pages in the patient medical record
- Your personal knowledge of patient financial services policies
- The master patient index entries themselves
- The spelling of the first and last names

**42. When merging of duplicate records, the organization policies**

- Define the MPI spelling rules
- Never explain the purpose of survivor and retiree records
- Always choose the oldest MPI number
- Dictate the requirements for merging records

**43. The MPI Simulation indicates that organizational policies will:**

- Always choose the newest address as the most correct address
- Always use address verification software
- Define the role of source and administrative records in merging MPI entries
- None of the above.

**44. Duplicate records in the master patient index may cause:**

- Increased administrative and clinical costs
- Adverse impact on quality documentation in the patient medical record or information
- Inability for the organization to provide cost-effective quality care
- All of the above

**PERSPECTIVES OF HIM FACULTY USE OF AN E- LEARNING LAB &**

45. Potential sources of verification information for master patient index entries include all of the following except:

- Other databases that may include social security information
- Signatures pages
- DNA and Finger prints
- Copies of identification cards filed in other records

**How would you rate your satisfaction with the e-HIM® Virtual Lab MPI Simulation on these performance issues?**

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Not Applicable
46. Overall, the MPI Simulation provides accurate information about the MPI.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
47. Overall, the MPI Simulation trains the student properly to resolve duplication of MPI entries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
48. Overall, I felt motivated to complete the MPI Simulation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
49. Overall, the MPI Simulation is easy to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
50. Overall, I can easily navigate the MPI Simulation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
51. Overall, I get to where I wanted to be located in this simulation in an acceptable number of steps.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
52. Overall, the MPI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



**PERSPECTIVES OF HIM FACULTY USE OF AN E- LEARNING LAB &**

Simulation is an ideal website.

53. Overall, the MPI Simulation met my expectations.

54. The MPI Simulation information was well structured/presented.

55. Using the MPI Simulation would enhance my teaching effectiveness.

56. I will return to this site to use the MPI Simulation.

57. I will return to this site to use the e-HIM® Virtual Lab.

58. Have you used other e-HIM® Virtual Lab applications?

- Yes
- No

**Please tell us about yourself:**

59. What is the location of your University, College or School?

City/Town:

State/Province:

60. In what type of program do you teach? Please choose all that apply.

- Coding Program
- HIA Program
- HIT Program
- Masters' Program
- Other (please specify)

## PERSPECTIVES OF HIM FACULTY USE OF AN E- LEARNING LAB &

### 61. In your current position do you work:

- Full-time (teach 3 courses or more than three courses, regardless of the number of credit hours)
- Part-time (teach less than three courses, regardless of the number of credit hours)
- Teaching is not my main responsibility
- Other (please specify)  
\_\_\_\_\_

### 62. What is your Faculty Status?

- Program Director
- Professor
- Associate Professor
- Assistant Professor
- Instructor / Lecturer
- Adjunct Instructor or Professor
- Graduate Teaching Assistant
- Other (please specify)  
\_\_\_\_\_

### 63. How do you rate your computer ability?

- Expert (Programming)
- Accomplished (Use macros and can do some simple programming)
- Good (Install most software and Troubleshooting some problems, using many types of software and programs including uploading documents and setting up a course in course management system)
- Pretty Good (Familiar with using many different types of software)
- Basic (Only use Internet or less than 5 programs)
- Limited (Use only 1 program or not at all)

### 64. What is your Gender?

- Male
- Female

### 65. What is your Age Group?

- 18 - 29
- 30 - 39
- 40 - 49
- 50 - 59
- 60 years or over 60 years
- Prefer not to answer

**PERSPECTIVES OF HIM FACULTY USE OF AN E- LEARNING LAB &**

66. Which Racial/Ethnic groups do you belong to?

- Caucasian
- African American
- Hispanic
- Latino
- Asian American
- Pacific Islander
- American Indians (Native Americans)
- Alaskan Native
- Prefer not to answer
- Other (please specify)

\_\_\_\_\_

Please share any additional comments you have in the box provided below.

\_\_\_\_\_

**\*\* Thank you for your time in completing this questionnaire. \*\***

If you have any questions about this research project, please contact Peggy Meli at 800-938-3840 or 407-463-3579, via email: [pmeli@mail.ucf.edu](mailto:pmeli@mail.ucf.edu) or my faculty supervisor, Dr. Sivo at 407-823-4147.

**APPENDIX B: CONSENT LETTER E-MAIL DOCUMENTS**

## Invitation to Participate Letter



Educational Research, Technology & Leadership  
College of Education  
PO Box 161250  
Orlando, FL 32816-1250

October 15, 2007

Dear Professor

I am writing to ask for your help in a study. I am a PhD Candidate in Instructional Technology at the University of Central Florida. I am conducting dissertation research this fall, under the supervision of Dr. Stephen A. Sivo, Professor and Senior Researcher, Educational Research, Technology, and Leadership, College of Education. The purpose of the research is to determine the PERSPECTIVES OF HEALTH INFORMATION MANAGEMENT FACULTY USE OF AN E-LEARNING LAB AND TECHNOLOGY ACCEPTANCE.

Your name and email address were given to me by your program director. We are conducting a cluster random sample of HIM Faculty currently involved with teaching or program administration for CAHIIM accredited, candidacy or AHIMA approved Coding Program, Associate Degree, or Baccalaureate Degree or Masters Degree program. Each Program was chosen randomly from the listing of similar programs (i.e. HIA, HIT, coding, etc.) on the CAHIIM website (<http://www.cahiim.org/directory/>).

Your answers from the survey will be analyzed and help researchers at the University of Central Florida (UCF) summarize the perspectives of health information management faculty use of an e-learning lab, educational practices and technology acceptance. The results of the study may help identify system functionality, system usability, perceived ease of use, perceived usefulness, attitude toward using technology and the e-learning lab, behavioral intention to use an e-learning lab. I propose to publish this research as my dissertation and possibly in Perspectives in Health Information Management.

You are being invited because you have been identified as a potential participant in an online survey which should take approximately 20 to 30 minutes to complete. Please be aware that you are not required to participate in this survey and you may discontinue your participation at any time without penalty. You may also omit any questions you prefer not to answer. The survey can be completed at your convenience. This research study has been approved by the Institutional

Review Board (IRB) at the University of Central Florida (UCF).

Your answers are completely confidential and will be released only as aggregates or summaries. No individuals' answers can be identified. This survey is voluntary. However, you can help us very much by taking a few minutes to share your experiences and opinions about your perceptions of technology and an e-learning laboratory.

Your responses will be analyzed and reported anonymously to protect your privacy. All electronic data will be kept on a password protected external hard drive. All data will be accessible only to the researcher and my advisor, Dr. Sivo.

**YOU MUST BE 18 YEARS OF AGE OR OLDER TO PARTICIPATE.** There are no anticipated risks. Any compensation or other direct benefits to you as a participant in this study are not provided by the researcher.

You are free to withdraw your consent to participate and may discontinue your participation in the survey at any time without consequences. **THE SURVEY WILL NOT BE LINKED TO YOUR EMAIL ACCOUNT OR YOUR INTERNET BROWSER**

Research at the University of Central Florida is conducted under the oversight of the UCF Institutional Review Board. Questions or concerns about research participants' rights may be directed to the UCF IRB office, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246. The telephone number is 407-823-2901.

The hours of operation are 8:00 am until 5:00 pm, Monday through Friday except on University of Central Florida official holidays.

You may want to print a copy of this email for your records.

Please allow 20 to 30 minutes for the pre-assessment, the site visit, and the post-assessment.

If you decide to participate in this research study, click on this link:

[https://www.surveymonkey.com/s.aspx?sm=VIDCCVzXL\\_2bCVC2j8GT4jcg\\_3d\\_3d](https://www.surveymonkey.com/s.aspx?sm=VIDCCVzXL_2bCVC2j8GT4jcg_3d_3d)

or copy and paste the link into your internet browser. THIS SURVEY USES "SECURE SOCKETS LAYER (SSL)" WHICH IS USED FOR TRANSMITTING INFORMATION PRIVATELY OVER THE INTERNET. Many corporations and academic institutions require SSL when collecting data.

Results of the research findings will be provided by the researcher at your request, which you may indicate in the section near the end of this letter.

If you have any questions or comments about the study, we would be happy to talk with you. Our toll free number is 800-938-3840, or 407/463-3579 or my faculty supervisor, Dr. Sivo at

407/823-4147.

Thank you very much for helping with this important study.

Sincerely,

Peggy L. Meli, Principal Investigator, Ph.D. Candidate,

\*\*\*\*\*

I would like to see the results of the research and am requesting a copy be sent to my email address, which is \_\_\_\_\_ . Please reply or send this email to: [pmeli@mail.ucf.edu](mailto:pmeli@mail.ucf.edu)

P.S. If by some chance we made a mistake and you are not HIM Faculty currently involved with teaching or program administration for a CAHIIM accredited, candidacy or approved coding, Associate degree, or Baccalaureate degree or Masters Degree program, please return respond to this email with you're a note about your status. Many Thanks.

## Follow-up Letter



University of Central Florida  
Educational Research, Technology & Leadership  
College of Education  
PO Box 161250  
Orlando, FL 32816-1250

December 10, 2007

Dear Professor ,

A few days ago, I emailed you the web link to survey about teaching experiences and technology acceptance. We are asking faculty about their experience using an E-learning lab. The survey will give you a preview of the E-learning lab and ask a few questions about your perceptions of the e-learning lab and your current use of instructional technology. No prior experience with an e-learning lab is required!

I realize this is a very busy time of the year as the semester is drawing to a close. However, we have contacted you and others now in hopes of obtaining the insights only HIM faculty like you can provide.

If you have already completed the survey, I thank you very much. Results from the survey will be analyzed and help researchers at the University of Central Florida (UCF) identify system functionality, system usability, perceived ease of use, perceived usefulness, attitude toward using technology and the e-learning lab, behavioral intention to use an e-learning lab.

If you have not yet had the time to complete the questionnaire, please do so as soon as possible. If you decide to participate in this research study, click on this link: [https://www.surveymonkey.com/s.aspx?sm=VIDCCVzXL\\_2bCVC2j8GT4jcg\\_3d\\_3d](https://www.surveymonkey.com/s.aspx?sm=VIDCCVzXL_2bCVC2j8GT4jcg_3d_3d) or copy and paste the link into your internet browser. As we mentioned before, your answers are completely confidential and will be released only as aggregates or summaries. No individuals' answers can be identified.

If you have any questions or comments about the study, we would be happy to talk with you. Our toll free number is 800-938-3840 or you can write to me at [pmeli@mail.ucf.edu](mailto:pmeli@mail.ucf.edu).



Sincerely,

Peggy

Peggy L. Meli, MS, RHIA, Licensed Healthcare Risk Manager (State of Florida)  
plmeli@mail.ucf.edu

## Second Follow-up-Letter



November 24, 2007

Dear Professor

Two weeks ago I sent you an email seeking your perceptions about using an E-learning lab and instructional technology. Your school was randomly selected from other HIA, HIT and Coding Programs. We are writing again because of the importance that your questionnaire has for helping to get accurate results. Although we sent questionnaires faculty in every area of the country, it's only by hearing from everyone in the sample that we can be sure that the results are truly representative.

We are asking faculty about their experience using an E-learning lab. The survey will give you a preview of the E-learning lab and ask a few questions about your perceptions of the e-learning lab and your current use of instructional technology. No prior experience with an e-learning lab is required! You also do not have to log into the AHIMA V-lab to take this survey.

If you have already completed the survey, please accept our sincere thanks. If you have not yet had the time to complete the questionnaire, please do so today. If you decide to participate in this research study, click on this link:

[https://www.surveymonkey.com/s.aspx?sm=VIDCCVzXL\\_2bCVC2j8GT4jcg\\_3d\\_3d](https://www.surveymonkey.com/s.aspx?sm=VIDCCVzXL_2bCVC2j8GT4jcg_3d_3d) or copy and paste the link into your internet browser.

We are especially grateful for your help because it is only by asking faculty like you to share your experiences that we can understand the role of system functionality, system usability, perceived ease of use, perceived usefulness, attitude toward using technology and the e-learning lab, behavioral intention to use an e-learning lab.

Regards,

Peggy

Peggy L. Meli, MS, RHIA, LHRM,

PhD Candidate, College of Education  
Educational Research, Technology & Leadership  
University of Central Florida

## Thank You Letter



Date

Dear Professor,

Thanks for the quick reply. I appreciate your time and willingness to complete the survey and contact me. It is only with the help of faculty like you that we can learn about the role of instructional technology in providing quality education for the HIM profession.

Thank you very much for helping with this important study.

Sincerely,

Peggy

## **APPENDIX C: CORRELATION MATRIX**

Observed Variables: ATT BI PEOU PI PU SEI SFU GAINS

Correlation Matrix

1.000  
.125 1.000  
.598 .297 1.000  
.383 .195 .430 1.000  
.635 .418 .681 .495 1.000  
.369 .210 .427 .481 .412 1.000  
.290 .450 .645 .053 .434 .246 1.000  
-.103 .189 -.012 -.127 -.080 .022 .040 1.000

Means

28.912 7.664 25.482 16.832 26.073 36.292 28.416 .985

Standard deviations

3.474 2.045 2.883 2.397 2.992 2.731 4.555 1.529

Sample Size 137

Relationships

GAINS = BI

BI = PU PEOU SFU

PU = PEOU SFU ATT SEI PI

PEOU =SFU ATT PI

## **APPENDIX D: IRB DOCUMENTS**



University of Central Florida Institutional Review Board  
Office of Research & Commercialization  
12201 Research Parkway, Suite 501  
Orlando, Florida 32826-3246  
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276  
[www.research.ucf.edu/compliance/irb.html](http://www.research.ucf.edu/compliance/irb.html)

### Notice of Exempt Review Status

From: **UCF Institutional Review Board**  
**FWA00000351, Exp. 5/07/10, IRB00001138**

To: **Peggy Meli**

Date: **October 04, 2007**

IRB Number: **SBE-07-05222**

Study Title: **PERSPECTIVES OF HEALTH INFORMATION MANAGEMENT FACULTY USE OF AN E-LEARNING LAB AND TECHNOLOGY ACCEPTANCE**

Dear Researcher:

Your research protocol was reviewed by the IRB Chair on 10/4/2007. Per federal regulations, 45 CFR 46.101, your study has been determined to be **minimal risk for human subjects and exempt** from further IRB review or renewal unless you later wish to add the use of identifiers or change the protocol procedures in a way that might increase risk to participants. Before making any changes to your study, call the IRB office to discuss the changes. **A change which incorporates the use of identifiers may mean the study is no longer exempt, thus requiring the submission of a new application to change the classification to expedited if the risk is still minimal.** Please submit the Termination/Final Report form when the study has been completed. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

The category for which exempt status has been determined for this protocol is as follows:

2. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures, or the observation of public behavior, so long as confidentiality is maintained.
  - (i) Information obtained is recorded in such a manner that the subject cannot be identified, directly or through identifiers linked to the subject, **and/or**
  - (ii) Subject's responses, if known outside the research would not reasonably place the subject at risk of criminal or civil liability or be damaging to the subject's financial standing or employability or reputation.

A **waiver of documentation of consent** has been approved for all subjects. Participants do not have to sign a consent form, but the IRB requires that you give participants a copy of the IRB-approved consent form, letter, information sheet, or statement of voluntary consent at the top of the survey.

All data, which may include signed consent form documents, must be retained in a locked file cabinet for a minimum of three years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained on a password-protected computer if electronic information is used. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

On behalf of Tracy Dietz, Ph.D., UCF IRB Chair, this letter is signed by:

Signature applied by Janice Turchin on 10/04/2007 01:41:26 PM EDT

IRB Coordinator

## LIST OF REFERENCES

- Adams, Scott (2008). Quote retrieved March 16, 2008 from <http://www.dilbert.com/comics/dilbert/index.html>.
- Agarwal, R. & Prasad, J. (1999). Are individual differences germane to the acceptance of new information technologies? *Decision Sciences*, 30(2), 361-391.
- AHIMA Advantage (2006). "The Future Has Arrived: A Look Back at 2006." 10:8. Retrieved March 16, 2008 from: AHIMA Members only resources: AHIMA Body of Knowledge, FORE Library, bok\_035872.doc.
- AHIMA Advantage (2008). "Building a New Vision of HIM Education." 12:1. Retrieved March 16, 2008 from: AHIMA Members only resources: AHIMA Body of Knowledge, FORE Library,
- AHIMA, (2002). "Data for decisions: The HIM workforce and workplace 2002 Member Survey." Retrieved March 1, 2008 from [http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1\\_018947.pdf#page%3D10](http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1_018947.pdf#page%3D10)
- AHIMA, (September 24, 2007). Vision 2016: A blueprint for quality education in health information management. Retrieved February 24, 2008 from [http://www.ahima.org/emerging\\_issues/Vision2016BlueprintforEduc.pdf](http://www.ahima.org/emerging_issues/Vision2016BlueprintforEduc.pdf)
- AHIMA, (2008). Retrieved January 26, 2008 from <http://www.ahima.org/about/about.asp>.
- Ajzen, I. & Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Aspden, P. Wolcott, J. Bootman, J. L. & Cronenwett, L.R. (Eds.). (2007). *Preventing Medication Errors: Quality Chasm Series*. Board on Health Care Services



- Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. New York: W.H. Freeman and Company. Institute of Medicine, Washington, DC: National Academies Press. Retrieved 11/06/2006 from: <http://fermat.nap.edu/books/0309101476/html>
- Bandura, A. (1986), *Social foundations of thought and action: A social cognitive theory*, Englewood Cliffs, NJ: Prentice-Hall.
- Bickford, C. J., Smith, K., Ball, M. J., Frantz, G., Panniers, T. L., Newbold, S. K. et al. (2005). Evaluation of a nursing informatics training program shows significant changes in nurses' perception of their knowledge of information technology. *Health Informatics Journal*, 11(3), 225.
- Bruner II, G. C. and Kumar, A. Explaining consumer acceptance of handheld Internet devices. *Journal of Business Research*, 58, 553– 558
- Burke, D. E. and Menachemi, N. (2004). Opening the black box: Measuring hospital information technology capability. *Health Care Management Review*, 29(3), 207-217.
- Burke, D., Menachemi, N. & Brooks, R.G. (2005). JHQ158- Diffusion of Information Technology Supporting the Institute of Medicine's Quality Chasm Care Aims. *Journal of Health Care Quality*. Jan-Feb; 27(1), 24–32, Retrieved 11/4/2006: [http://www.nahq.org/journal/ce/article.html?article\\_id=224](http://www.nahq.org/journal/ce/article.html?article_id=224)
- Burton-Jones, A. & Hubona, G.S. (2006). The mediation of external variables in the technology acceptance model. *Information and Management*, 43, 706–717
- Carlson, S., (2004). The next-generation classroom. *Chronicle of Higher Education*, 50(25), A26-A28.
- Chau, P. Y. K. (1996). An empirical assessment of a modified technology acceptance model. *Journal of Management Information Systems*, 13 (2), 185-204.

- Carswell, A. D. and Venkatesh, V. (2002) Learner outcomes in an asynchronous distance education environment. *International Journal of Human-Computer Studies*, 56, 475–494
- Cornell, R. (2001). Scaling the cyberheights: How far will we go? In L.R. Vandervert, L.V. Shavinina, & R.A. Cornell (Eds.), *Cybereducation: The future of long distance learning* (pp. 3-11), Larchmont, NY: Mary Ann Liebert.
- Davis, F.D. (1986). A technology acceptance model for empirically testing new end-user information systems: Theory and Results. Unpublished doctoral dissertation, MIT Sloan School of Management, Cambridge, MA.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13 (3), 319-340.
- Davis; F. D. (1993). User acceptance of information technology: System characteristics, user perceptions and behavioral impacts. *International Journal of Man-machine Studies*, 38, 457-487.
- Davis; F. D., Bagozzi; R.P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models *Management Science*, 35(8), 982-1003.
- Davis, F. D. & Venkatesh, V. (2004). Toward Preprototype User Acceptance Testing of New Information Systems: Implications for Software Project Management. *IEEE Transactions on Engineering Management*, 51(1), 31-46.
- Dearnley, C., Dunn, G. & Watson, S. (2006). An exploration of on-line access by non-traditional students in higher education: A case study. *Nurse Education Today*, 26, 409-415.
- Dewey, J. (1920). *Reconstruction in Philosophy*. Retrieved February 24, 2008 from <http://books.google.com/books?id=ZUg8AAAAIAAJ&pg=PA1&dq=reconstruction+in+philosophy#PPR5,M1> .

- Dillman, D.A. (2000). *Mail and Internet surveys: The tailored design method* (2<sup>nd</sup> ed.). New York: John Wiley Co.
- Dillon, A. & Morris, M.G. (1996). User acceptance of information technology: Theories and models. *Annual Review of Information Science and Technology*, 31, 3-32.
- Dixon-Lee, C. (2007). Personal Communication.
- Dunn, P. (2007) Can Big Business Save Health Care? *Hospitals & Health Networks*; 81(1), 38-46
- Fan, X. & Sivo, S.A., (2005) Sensitivity of Fit Indexes to Misspecified structural or measurement model components: Rationale of two-index strategy revisited. *Structural Equation Modeling*, 12(3), 343–367
- Fishbein, M. & Ajzen, I. (1975). *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*, Addison-Wesley, Reading, MA.
- Goodhue, D. L. (1998). Development and measurement validity of a task-technology fit instrument for user evaluation of information systems, *Decision Sciences*, 29(1), 105-138.
- Green, A., Fowler, C., Sportsman, S., Cottenoir, M., Light, K., Schumann, R., (2006). Innovation in nursing education: a statewide grant initiative. *Policy, Politics, & Nursing Practice*, 7(1), 45-53.
- Hair, J. F., Black, W.C., Babin, B.J. Anderson, R.E. & Tatham, R.L. (2006). *Multivariate Data Analysis* (6<sup>th</sup> Ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- Hatcher, L. (1994). *A step-by-step approach to using SAS for Factor Analysis and Structural Equation Modeling*. Cary, NC: SAS Publishing.

- Hayes, Taub, Robinson, III, E. H. & Sivo, S. A. (2003). An empirical investigation of the efficacy of multimedia instruction in counseling skill development. *Counselor Education and Supervision, 42*, 177-188.
- Hu, P. J., Chau, P. Y. K., Liu Sheng, O. R., & Yan Tam, K. (1999). Examining the technology acceptance model using physician acceptance of telemedicine technology. *Journal of Management Information Systems, 16*(2), 91-112.
- Igbaria, M., Zinatelli, Cragg, P. & Cavaye, A. L. M. (1997). Personal computing acceptance factors in small firms: A structural equation model. *MIS Quarterly, 21*, 279-305.
- Ilie, V. (2005). What do physicians want? Information technology acceptance and usage by healthcare professionals. (Doctoral Dissertation, University of Central Florida) Dissertation Abstracts International, DAI-A 66/10, Apr 2006. (AAT 3193483).
- Institute of Medicine (2000). To Err is Human: Building a Safer Health System. Kohn, L.T., Corrigan, J. M., & Donaldson, M.S. (Eds.) Committee on Quality of Health Care in America. National Academy Press, Washington, DC. Retrieved 07/19/06 from <http://darwin.nap.edu/books/0309068371/html>
- Institute of Medicine (2001). Crossing the Quality Chasm: A New Health System for the 21st Century. Committee on Quality of Health Care in America, Retrieved 07/19/2006 from: [http://books.nap.edu/catalog/10027.html?onpi\\_webextra3](http://books.nap.edu/catalog/10027.html?onpi_webextra3)
- Institute of Medicine (2003). Health Professions Education: A Bridge to Quality, Board on Health Care Services, The National Academies Press: Washington D.C.
- Institute of Medicine (2006). Preventing Medication Errors, Brief Report .Committee on Identifying and Preventing Medication Errors, Retrieved 07/31/2006 from <http://www.iom.edu/Object.File/Master/35/943/medication%20errors%20new.pdf>

- Karsh, B-T. (2004). Beyond usability: Designing effective technology implementation systems to promote patient safety. *Quality and Safety in Health Care*, 13, 388-394.
- Kaushal, R. Blumenthal, D., Poon, E.G., Jha, A.K.Franz, C., Middleton, B., et al. (2005). The costs of a national health information network. *Annals of Internal Medicine*, 143(3), 165-173.
- Kersten, S. (2007). Personal Communication.
- Kersten, S., Saigal, M. and Owens, K., (September, 2006). "HIM Laboratory: Delivering e-HIM Technology to Colleges and Universities—Virtually." *Journal of AHIMA*, 77(8) 26-30.
- Kinney, K. (2007). A systems approach to purchasing and implementing new technology. *Nursing Administration Quarterly*, 31(1), 27-32.
- Kohn, L. T. Corrigan, J. M. & Donaldson, M.S. (Eds.), (2000). *To Err Is Human: Building a Safer Health System*. Committee on Quality of Health Care in America, Institute of Medicine Washington, DC: National Academies Press. Retrieved 07/19/2006 from: <http://fermat.nap.edu/catalog/9728.html#toc>
- Kukafka, Johnson, Linfante & Allegtante, (2003). Grounding a new information technology implementation framework in behavioral science:A systematic analysis of the literature on IT use. *Journal of Biomedical Informatics*, 36, 218-227.
- Landry, B.J., Griffeth, R. & Hartman, S. (2006). Measuring student perceptions of blackboard using the technology acceptance model. *Decision Sciences Journal of Innovative Education*, 4(1), 87-99.
- Lee, C.-Y. (2002). The impact of self-efficacy and task value on satisfaction and performance in a Web-based course. Doctoral dissertation, University of Central Florida, Orlando

- Legris, P., Ingham, J., & Colletette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management*, 40, 191-204.
- Li, H. (2002). *Distance Education: Pros, cons and the future*. Paper presented at the Annual Meeting of the Western States Communication Association, Long Beach, CA March 2-5 2002) (ERIC Document Reproduction Service No. ED 461 903)
- Liaw, S.-S. (2002). Understanding use perceptions of world-wide web environments. *Journal of Computer Assisted Learning*, 18, 137-148.
- Liaw, S-S, Chang, W-C, Hung, W-H, Huang, H-M., (2006). Attitudes toward search engines as a learning assisted tool: approach of Liaw and Huang's research model. *Computers in Human Behavior*, 22, 177-190
- Madsen, J.A. (2007). Senior's health information website: Technology acceptance related to information retention. Unpublished doctoral dissertation, University of Central Florida, Orlando, FL.
- McDonald, R. P. & Marsh, H.W. (1990), Choosing a multivariate model: noncentrality and goodness of fit. *Psychological Bulletin*, 107(2) 247-255.
- McFarland, D.J., and Hamilton, D. (2006). Adding Contextual specificity to the technology acceptance model. *Computers in Human Behavior*, 22, 427-447.
- Morris, M.G. & Dillon, A. (1997). How user perceptions influence software use. *IEEE Software*, July/August 1997, 58-64.
- Mulaik, S. A., (1998). Parsimony and model evaluation. *Journal of Experimental Education*, 66(3). Retrieved 10/ 8/06 from: *Academic Search Premier*.

- National Academy of Engineering (2003). *Information Technology (IT) based Educational Materials Workshop Report with Recommendations*. The National Academies Press: Washington D.C. [http://www.nap.edu/catalog.php?record\\_id=10768#toc](http://www.nap.edu/catalog.php?record_id=10768#toc)
- National Postsecondary Education Cooperative (2004). *How Does Technology Affect Access in Postsecondary Education? What Do We Really Know?* (NPEC 2004–831), prepared by Ronald A. Phipps for the National Postsecondary Education Cooperative Working Group on Access-Technology. Washington, DC. Retrieved 7/17/2006 from: <http://nces.ed.gov/pubs2004/2004831.pdf>
- Ngai, E. W. T., Poon, J. K. L., & Chan, Y. H. C., (2007). Empirical examination of the adoption of WebCT using TAM. *Computers and Education*, Retrieved 11/04/06 from [www.elsevier.com/locate/comphumbeh](http://www.elsevier.com/locate/comphumbeh)
- Pan, C. C. (2003). System use of WebCT in the light of the technology acceptance model: A student perspective. Unpublished doctoral dissertation, University of Central Florida, Orlando, FL.
- Pan,C.C., Gunter,G. Sivo, S.& Cornell,R.,(2004-2005). End-user acceptance of a learning management system in two hybrid large sized introductory undergraduate courses: A case study. *Journal of Educational Technology Systems*, 33(4), 355-365.
- Pan, C., Sivo, S. A., & Brophy, J. (2003). Students' attitude in a Web-enhanced hybrid course: A structural equation modeling inquiry. *Journal of Educational Media and Library Sciences*, 41(2), 181-194.
- Park, H. (2004). Factors that affect information technology adoption by teachers. Unpublished doctoral dissertation, University of Nebraska.

- Perception. (1992). In *Academic Press Dictionary of Science and Technology*. Retrieved March 16, 2008, from <http://www.credoreference.com/entry/3140651>
- Phipps, R., and Merisotis, J. (2000). *Quality on the line: Benchmarks for success in internet-based distance education*. Institute for Higher Education Policy. Retrieved March 15, 2007 from: <http://www.ihep.com>.
- Pituch, K.A., & Lee, Y. (2006). The influence of system characteristics on e-learning use. *Computers & Education, (47)*, 2220244.
- Poon, E.G. Jha1, A. K., Christino, M., Honour, M. M., Fernandopulle, R., Middleton, B., et al. (2006). Assessing the level of healthcare information technology adoption in the United States: A snapshot. *BMC Medical Informatics and Decision Making, 6(1)*. Retrieved 11/3/06 from <http://www.biomedcentral.com/1472-6947/6/1>
- Raykov, T. & Marcoulides, G.A., (1999). Teacher's Corner: On desirability of Parsimony in Structural Equation Model Selection. *Structural Equation Modeling, 6(3)*, 292-300.
- Reality. (2006). In *Mosby's Dictionary of Medicine, Nursing, & Health Professionals*. Retrieved March 16, 2008, from <http://www.credoreference.com/entry/6689699>
- Rogers, E. M. (2004). A prospective and retrospective look at the diffusion model. *Journal of Health Communication, 9*, 13–19.
- Saade, R. & Bahli, B., (2005). The impact of cognitive absorption on perceived usefulness and perceived ease of use in on-line learning: An extension of the technology model. *Information and Management, 42*, 317-327.
- Sahin, I. & Thompson, A., (2006). Using Roger's theory to interpret instructional computer use by COE faculty. *Journal of Research on Technology in Education, 39(1)*, 81-104..



- Schaper, L. K. & Pervan, G. P., (2006-in Press). ICT and OTs: A model of information communication technology acceptance and utilization by occupational therapists. *International Journal of Medical Informatics*.
- Selim, H. M., (2003). An empirical investigation of student acceptance of course websites. *Computers & Education, 40*, 343-360.
- Schumacker, R. E. & Lomax, R.G. (2004). *A beginner's guide to structural equation modeling* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.
- Shadish, W.R., Cook, T.D, & Campbell, D.T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. NewYork: Houghton Mifflin Company.
- Shih, H.-P., (2006). Assessing the effects of self-efficacy and competence on individual satisfaction with computer use: An IT student perspective. *Computers in Human Behavior, 22*, 1012-1026.
- Shortliffe, E. H., (2005). Strategic action in health information technology: Why the obvious has taken so long. *Health Affairs, 24(5)*, 1222 – 1233.
- Sivadas, E. and Dwyer, R. F. (2000). An examination of organizational factors influencing new product success in internal and alliance-based processes. *Journal of Marketing, 64(1)*, 31-49.
- Sivo, S. A. (2006). Personal communication.
- Sivo, S. A., Pan, C., & Brophy, J. (2004). Temporal cross-lagged effects between subjective norms and system user attitudes regarding the use of technology. *Journal of Educational Media and Library Sciences, 42(1)*, 63-73.

- Sivo, S. A., & Pan, C. (2005). Undergraduate engineering and psychology students' use of a course management system: A factorial invariance study of user characteristics and attitudes. *The Journal of Technology Studies*, 31(2), 94-103.
- Sivo, S.A. Saunders, C., Chang, Q. and Jiang, J.J. (2006). How low should you go? Low response rates and the validity of inference in IS questionnaire research. *Journal of Association for Information Systems*. 7 (6) Article 18, 351-414.
- Smith, J. A.B. (2006). The effect of social presence on teacher technology acceptance, continuance intention, and performance in an online teacher professional development course. Unpublished doctoral dissertation, University of Central Florida, Orlando, FL.
- Snyder, T.D., Tan, A.G., & Hoffman, C.M. (2005). *Digest of Education Statistics 2004*, (NCES 2006005). U.S. Department of Education, National Center for Education Statistics. Washington, DC: Government Printing Office. Retrieved 7/17/2006 from <http://nces.ed.gov/programs/digest/d04/index.asp>.
- Sun, H. & Zhang, P. (2006). The role of moderating factors in user technology acceptance. *International Journal of Human-Computer Studies*, 64, 53–78.
- Swanson, E. B. (1974). Management Information Systems: Appreciation and involvement, *Management Science*, 21(3), 178-188.
- Swanson, E. B., (1988). *Information System Implementation: Bridging the gap between design and utilization*. Homewood, IL: Irwin.
- Tabachnick, B. G. & Fidell, L. S. (2007). *Using Multivariate Statistics* (5<sup>th</sup> Ed.). Boston: Pearson, Allen and Bacon.
- Thomas, G. and Carroll, S. (2006). Curriculum revision: Product innovation for quality outcomes. *Quality in Management in Health Care*, 15(4), 285-290

- Venkatesh, V. (2000). Determinants of Perceived Ease of Use: Integrating Control, Intrinsic Motivation and Emotion into the Technology Acceptance Model. *Information Systems Research* 11(4), 342-365.
- Venkatesh, V. and Brown, S.A. (2001). A Longitudinal Investigation of Personal Computers in Homes: Adoption Determinants and Emerging Challenges. *MIS Quarterly* 25(1), 71-102.
- Venkatesh, V., & Davis, F. D. (1996). A model of antecedents of perceived ease of use: Development and test. *Decision Sciences*, 27(3), 451-481.
- Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186-204.
- Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, 27(3), 425-478.
- U.S. Department of Health and Human Services (2004). "The Decade of Health Information Technology: Delivering Consumer-Centric and Information-Rich Health Care. A Framework for Strategic Action," available from: [HTUhttp://www.hhs.gov/UTH](http://www.hhs.gov/UTH). Accessed October 30, 2006
- Waits, T., & Lewis, L. (2003). Distance Education in Degree-Granting Postsecondary Institutions 2000–2001 (NCES 2003–017). U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved 7/17/2006 from: <http://nces.ed.gov/pubs2003/2003017.pdf>.
- Wilner, A. & Lee, J.(2002). Higher education research center: The promise and the reality of distance education. *NEA Update* 8(3), 1-4. Retrieved 7/17/2006 from: <http://www2.nea.org/he/heupdate/vol8no3.pdf>

- Wolters, C.A. & Daugherty, S.G. (2007). Goal Structures and Teachers' Sense of Efficacy: Their Relation and Association to Teaching Experience and Academic Level. *Journal of Educational Psychology*, 99(1), 181–193
- Wu, J-H., Wang, S-C. & Lin, L-M. (2007). Mobile Computing acceptance factors in the healthcare industry: A structural equation model. *International Journal of Medical Informatics*. Retrieved 3/3/08 from [www.intl.elsevierhealth.com/journal/ijmi](http://www.intl.elsevierhealth.com/journal/ijmi) (doi:101016/j.ijmedif.2006.06.006.)
- Yang, H-H. (2007). The effect of technology acceptance on undergraduate students usage of WebCT as a collaborative tool. Unpublished doctoral dissertation, University of Central Florida, Orlando, FL.