Spring 5-2013

Learner Retention of Medical Vocabulary Based on Instructional Format and Success in Medical Coding

Madelon Reed Gruich

University of Southern Mississippi

Follow this and additional works at: https://aquila.usm.edu/dissertations

Part of the Curriculum and Instruction Commons, Educational Methods Commons, and the Instructional Media Design Commons

Recommended Citation

Gruich, Madelon Reed, "Learner Retention of Medical Vocabulary Based on Instructional Format and Success in Medical Coding" (2013). Dissertations. 29.

https://aquila.usm.edu/dissertations/29

This Dissertation is brought to you for free and open access by The Aquila Digital Community. It has been accepted for inclusion in Dissertations by an authorized administrator of The Aquila Digital Community. For more information, please contact Joshua.Cromwell@usm.edu.
LEARNER RETENTION OF MEDICAL VOCABULARY BASED ON INSTRUCTIONAL FORMAT AND SUCCESS IN MEDICAL CODING

by

Madelon Reed Gruich

Abstract of a Dissertation
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

May 2013
ABSTRACT

LEARNER RETENTION OF MEDICAL VOCABULARY BASED ON INSTRUCTIONAL FORMAT AND SUCCESS IN MEDICAL CODING

by Madelon Reed Gruich

May 2013

This quantitative research study explores the correlation between instructional formats and the measurement of knowledge retention, as well as subsequent course mastery and whether other factors such as age, ethnicity, gender, number of study hours, number of work hours, and family responsibilities influence learning outcomes. The healthcare data technology program attracts large numbers of individuals seeking training in this administrative healthcare field and was the focal area of the research for this study.

The participants in the study were the students enrolled in the healthcare data technology program of a southeastern community college, preparing for employment in the medical billing and coding field. Data collected include medical terminology final exam scores obtained from online and face-to-face instructional formats and medical procedural coding final exam scores. These scores were compared to determine if a relationship exists between medical vocabulary knowledge retention levels and coding mastery. In addition to one-way Analysis of Variance and Analysis of Covariance, the study also utilizes descriptive analysis of demographic data and responses to a questionnaire regarding participants’ opinions of their online or face-to-face instructional experiences.

Findings of the study indicate that the face-to-face instructional format results in higher means of medical terminology final exam scores and knowledge retention, while
coding proficiency tends to be about the same regardless of instructional format. Students may decide to take virtual courses online but still prefer the face-to-face instructional format where greater interaction with instructors is more likely. Moreover, this study supports research literature that other factors such as self-efficacy, innate motivation, and satisfaction with instructional format affect learning.
The University of Southern Mississippi

LEARNER RETENTION OF MEDICAL VOCABULARY BASED ON INSTRUCTIONAL FORMAT AND SUCCESS IN MEDICAL CODING

by

Madelon Reed Gruich

A Dissertation
Submitted to the Graduate School
Of The University of Southern Mississippi
In Partial Fulfillment of the Requirements
For the Degree of Doctor of Philosophy

Approved:

Shuyan Wang
Director

Kyna Shelley

Taralynn Hartsell

Sharon Rouse

Susan A. Siltanen
Dean of the Graduate School

May 2013
ACKNOWLEDGMENTS

I would like to express my heartfelt appreciation to the following esteemed faculty members at The University of Southern Mississippi for serving on my dissertation committee: Dr. Shuyan Wang, chairperson and program advisor; Dr. Kyna Shelley, methodologist; and Dr. Taralynn Hartsell and Dr. Sharon Rouse, committee members. Their encouragement, guidance, and expertise were invaluable in this research project. Thank you, also, to my family, friends, and colleagues for their constant support.
TABLE OF CONTENTS

ABSTRACT ............................................................................................................................. ii

ACKNOWLEDGMENTS ........................................................................................................ iv

LIST OF TABLES .................................................................................................................. vii

CHAPTER

I. INTRODUCTION .............................................................................................................. 1

  Background
  Statement of the Problem
  Purpose of the Study
  Research Hypotheses
  Justification for the Study
  Delimitations and Researcher Assumptions
  Definition of Terms
  Summary

II. REVIEW OF RELATED LITERATURE ........................................................................... 17

  Theoretical Framework
  Instructional Learning Theories
  Community College Role in Learning
  Distance Learning Via Online Instruction
  Online Instructional Design
  Adults and Learning
  Learning Outcomes and Knowledge Retention
  Medical Billing and Coding
  Summary

III. METHODOLOGY ......................................................................................................... 70

  Research Setting
  Research Participants
  Research Design
  Instrumentation
  Data Collection Procedure
  Data Analysis
  Summary

IV. RESULTS ..................................................................................................................... 88

  Research Question
  Research Hypothesis 1
Research Hypothesis 2
Research Hypothesis 3
Summary

V. DISCUSSION ............................................................................................................... 100

Discussion of Findings
Conclusions
Limitations and Implications
Recommendations
Summary

APPENDIXES ............................................................................................................. 111

REFERENCES ............................................................................................................. 121
LIST OF TABLES

Table

1. Frequencies of Participants’ Demographics ......................................................... 89

2. Participants’ Satisfaction Regarding Selection of Instructional Format of Medical Terminology Course ................................................................. 91

3. Questionnaire Statements Based on Age and Class Format ................................. 93

4. Means of Medical Terminology Scores Based on Study Hours and Class Format . 94

5. Class Format Effect on Medical Terminology ....................................................... 96

6. Class Format Effect on Retention ......................................................................... 97

7. Class Format Effect on Coding ........................................................................... 98

8. Class Format Effect on Coding, Covarying Retention .......................................... 98
CHAPTER I

INTRODUCTION

Successful learner outcomes in medical coding courses remain a critical objective in preparing completers in the healthcare data technology (HDT) program entering the administrative healthcare field as billers and coders (American Academy of Professional Coders, 2012). While coding expertise can be measured objectively, indicators of medical coding success have not been identified. A number of factors, such as instructional format of a medical terminology course, retention of medical vocabulary, amount of study time devoted to the discipline, work and family responsibilities, age, and ethnicity were examined to determine any potential influence on learning outcomes in the coding courses.

Background

Online instruction has become a viable instructional option for colleges and universities since the advent and availability of the World Wide Web. Where face-to-face classrooms had once been the norm for teaching and learning, Web-based online learning environments are now attracting traditional and nontraditional learners. The continuous increase in popularity of online instruction permeates all educational disciplines, including the training of individuals in healthcare administrative tasks (Harris & Parrish, 2006).

Online Assessment

With the demand for online courses, assessing performance of learners and ensuring knowledge retention becomes critical in the overall picture of program success in colleges and universities. The ability to determine student learning outcomes plays a
significant role in determining the success of courses in the HDT program. Course objectives provide the outline in which content is presented and by which students gain skills necessary to complete the program. Job success in medical coding depends on the acquisition of administrative medical skills and knowledge aligned with industry standards in the training program. Assessing course competencies occurs through recall of factual knowledge and application to workplace scenarios.

Furthermore, medical vocabulary knowledge retention allows a fluid transition from classroom to workplace. Medical vocabulary, the specialized language of healthcare, necessitates constant study and practice. Retaining medical words associated with anatomy, physiology, pharmacology, and medical procedures and services, creates an opportunity to apply the vocabulary for coding purposes. Determining the performance levels of learners, then, becomes a viable concern for instructors.

Distance Learning Students

In most institutions, learners who enroll in online courses tend to be the same learners who enroll in face-to-face courses (Sapp & Simon, 2005). Therefore, instructors who teach both face-to-face and online classes likely encounter the same learners. Although disagreement prevails, Manochehri and Young (2006) assert that performance levels of learners tend to be similar between the two instructional formats but that increased time management, self-motivation, independence, self-efficacy, and collaboration skills are necessary for academic success in the online environment. Understanding the factors that attribute to online success enables instructional content to be designed to enhance learning performance.
Distance education, employed in higher education as a means to reach diverse student populations, addresses such issues ranging from limited classroom space to limited funding (Sapp & Simon, 2005). Sapp and Simon (2005) contend that the shift from face-to-face to online distance learning environments presents challenges in providing sound pedagogy and measuring student performance outcomes. Furthermore, they argue that integrity of course grading and content, regardless of instructional format, must be protected (Sapp & Simon, 2005). The manner in which communication occurs between student and instructor generates one of the main differences cited by learners when comparing online and face-to-face instructional formats (Harris & Parrish, 2006).

Studies indicate that a learner’s overall grade point average predicts online performance (Harris & Parrish, 2006). Not all learners are capable of meeting the objectives of online course content delivery; thus, learners lacking self-discipline and initiative are more likely to perform poorly in the online environment (Sapp & Simon, 2005). Some learners, according to Sapp and Simon (2005), believe that online classes are easier and less demanding than face-to-face classes, although evidence supports an opposing view.

*Learning Preferences*

Learning preferences, long debated in academia regarding their predictive measures of student performance and achievement, suffuse the dialogs between educators and learners, having significant presence in the online setting. Educators continue to focus on learning preferences regardless of format as they design instructional content to meet learners’ needs. Learning preferences, frequently discussed in literature, commonly refer to visual, auditory, and kinesthetic preferences of receiving and giving information.
(Mestre, 2010). Learning preferences, although irrelevant for face-to-face classes, increase in significance in Web-based classes (Manochehri & Young, 2006). The complexity of learning necessitates quality learning environments based on proven principles of multiple learning theories (Johnson & Aragon, 2002). Understanding how learners learn best assists the online instructor in developing content that appeals to all learners with the goal of knowledge retention of the material presented.

Learning Medical Vocabulary

Learners exposed to education-based and real-world learning tasks perform those tasks based on their preferences and general abilities (Johnson & Aragon, 2002). As in any discipline, the level of knowledge retention in medical terminology courses may be an indicator of subsequent medical coding success; therefore, regardless of format, instructors must provide learning opportunities that guarantee mastery. When developing online course equivalents of face-to-face courses, instructors can incorporate innovative methodology that enriches the learner’s experience (Johnson & Aragon, 2002).

Motivating learners to study and learn is a key ingredient in the learning process. Often used by instructors, Kellar’s ARCS model of motivation—attention, relevance, confidence, and satisfaction—creates a learning environment that initiates interaction, encourages participation, aligns with personal and professional goals, and presents a challenge (Johnson & Aragon, 2002). Yet, another consideration when designing online content is to avoid presenting too much information in a short amount of time, according to Johnson and Aragon (2002). Because of the magnitude of information presented in medical terminology and coding courses, these foregoing concepts educe caution in content design.
To ensure retention of medical vocabulary, the learning concept of presenting smaller learning segments and building on mastery of facts directly applies to presenting medical vocabulary in a sequential and segmental fashion to promote student achievement and to ensure knowledge retention. In preparation for a career in the medical billing and coding field, an individual requires a series of sequential information beginning with medical vocabulary. Unfamiliarity with medical terminology will prevent the accurate abstraction of medical healthcare facts from the medical record that are necessary for assigning the correct codes for reimbursement (Nutescu & Klotz, 2007).

Learning medical vocabulary requires cognitive ability. Review and practice are essential in the memorization of terms and lead to knowledge retention and long-term memory transfer that eventually become automatic responses when needed (Chipperfield, 2004). Because the knowledge of medical terminology is the foundation of medical billing and coding, mastery of this specialized healthcare language is essential. Understanding medical terminology improves the odds of receiving healthcare reimbursement for services provided to the patient (Nutescu & Klotz, 2007). As institutions offer training in the medical billing and coding area, they consequently face the challenge of providing sound instructional pedagogy to assist individuals in attaining the skills and proficiency needed to be successfully employed in the healthcare administrative field.

Learners decide which medical terminology instructional format to select—online or face-to-face—and assume responsibility for their learning while instructors guide and facilitate. Armed with a better understanding of the effects of medical vocabulary knowledge retention on coding mastery, instructors and learners make better choices
pertaining to instructional format, content requirements, and study options. Measuring medical vocabulary retention necessitates continual recall, assessment, and remediation. As with any endeavor, success depends to a great degree on the personal commitment and attributes of the learner, but a quality educational experience that provides the mechanism and incentives for achievement cannot be underestimated.

Statement of the Problem

Numerous career and technical programs exist at the community college level, providing individuals with options that improve their lifestyles through career preparation. In the administrative healthcare data technology program specifically, training equips students with skills for positions such as medical billing and coding specialists. The ultimate goal of program completers is to become nationally credentialed and to obtain employment. Many graduates of the program successfully realize their goals, while others are unable to either pass certification exams or find employment following their training. This lack of certification and employment for all program completers poses challenges to be addressed.

According to data provided by the Bureau of Labor Statistics (BLS), job prospects in the healthcare technology field will continue to increase through 2018 as a result of an aging population experiencing an increase in health-related issues that require more medical tests, treatments, and procedures (BLS, 2011). In 2008 some 172,500 jobs were available for medical records and healthcare technicians, and by 2018 over 206,700 jobs are predicted to exist—an increase of 20%. Because the adoption of electronic health records (EHR) is increasing, healthcare data management technicians require appropriate training.
Not only are specific medical skills necessary in career success, but computer software and technology proficiency are skills that also appeal to and are required by employers. Employers demand that individuals in the healthcare data technology field possess strong oral and written communication skills, in addition to medical vocabulary knowledge, because they often serve as liaisons between healthcare entities, insurance companies, and other agencies (BLS, 2011).

Some students are not able to master medical vocabulary. Others perform well on medical vocabulary tests but cannot retain the medical terms when used in subsequent coding classes. Successful transition and completion of courses that rely on previously attained basic knowledge across the healthcare data technology discipline result in the acquisition of knowledge pertinent to career success. Attainment of learning goals during training increases the potential for job placement. However, there is a lack of studies regarding whether instructional format makes a difference in medical vocabulary retention and application to medical coding.

A further issue affecting healthcare data technology programs and community colleges is the high attrition rate for online classes and technical programs alike. Retaining students increases graduates’ chances for better job placement and improved financial status, as well as increasing completion rates for educational institutions. The two-year technical programs provide an avenue for adults who desire to obtain employment immediately following program completion. With competition for jobs at a premium, only the most qualified and interview-savvy graduates will survive. The major goal of the healthcare data technology program is to guarantee that the graduates possess the advanced skills of medical coding required for this employment sector.
Purpose of the Study

The purpose of this study was to investigate if the instructional format of a medical vocabulary course affects knowledge retention and the learning outcomes of students in subsequent medical coding courses. Furthermore, other factors were identified to determine if they influenced knowledge retention of medical vocabulary and coding mastery. A comparison of final exam scores and repeated final exam scores in the following semester in online and face-to-face medical vocabulary instructional formats determined if the instructional format made a difference in medical vocabulary knowledge retention.

The study further sought to investigate whether instructional class format and knowledge retention together impacted student learning outcomes and achievement in procedural coding. Interest in other factors—family responsibilities, the number of hours devoted to studying and working, and ethnicity—and their potential for influencing medical vocabulary knowledge retention and subsequent medical coding success created further purpose for the study. The increasing availability of and demand for online instructional formats evoke the need on behalf of educators and learners to understand how online course designs equate with positive learning outcomes in medical terminology.

Comparisons of medical vocabulary knowledge retention between online and face-to-face instructional formats provide the basis for identifying successful student learning outcomes. Successful postsecondary learners in administrative healthcare training programs achieve entry-level career competencies required for employment and certification and possess fundamental skills and knowledge needed to develop coding
mastery. Following successful program completion, learners in administrative healthcare careers possess employable skills, in addition to the necessary knowledge to complete and pass a national coding certification examination that supports industry-standard competencies. The expected outcome of the program ensures that learners acquire the necessary abilities and proficiencies for employment and certification; thus, instructors and learners alike show interest in research findings indicating how this outcome occurs. A distinct absence of research that specifically addresses medical vocabulary retention and its effect on coding courses led the research to explore this area. Furthermore, examination of other factors that could impact coding medical vocabulary knowledge retention provided additional information.

Research Hypotheses

As the basis of this research study, the following three research hypotheses and one research question were designed. The goal of each was to examine the levels of medical vocabulary knowledge retention and subsequent coding success:

Research Hypothesis 1: Medical terminology performance scores differ based on instructional format.

Research Hypothesis 2: Knowledge retention levels of medical terminology differ based on instructional format.

Research Hypothesis 3: Scores on medical coding final exam differ as a function of medical terminology class type, covarying knowledge retention.

Research Question: Do other factors—age, ethnicity, the number of hours devoted to study, childcare or family responsibilities, and the number of work hours—
separately or in combination make a difference in medical vocabulary knowledge retention and the outcome of procedural medical coding?

Justification for the Study

Several basic premises provide justification of this research study: (a) continued increase in online participation, (b) conflicting opinions regarding effectiveness and performance in online and face-to-face courses, (c) intrinsic/extrinsic factors involved in learning, and (d) correlation between knowledge retention of medical vocabulary and medical coding success.

The phenomenal growth of online education opportunities in higher education is generating some complex instructional and learning issues for instructors and learners alike in the healthcare data technology field. Distance learning has gained a position of pedagogical importance in academia while simultaneously creating new dynamics in an already-complex process. Most of the courses in the healthcare data technology curriculum are offered online. As more and more individuals opt to complete courses and programs via online instruction, attention to course design, knowledge retention, student satisfaction, and ensuring mastery of course content are factors to consider when designing and offering medically related courses.

Learners have choices of online or face-to-face instructional format at the undergraduate and graduate levels. Research studies indicate conflicting opinions regarding the effectiveness and performance levels of learners in online and face-to-face classes (Detwiler, 2008; Summers, Waigandt, & Whittaker, 2005). As learners across all disciplines choose Web-based instructional formats, achieving optimal learning outcomes and course objectives is an ongoing instructional process. In order to satisfy the demand
for an online presence, medical terminology courses have been designed to present specific medical vocabulary that is needed to complete subsequent courses in the healthcare data technology program. A comparison of student learning outcomes in medical vocabulary instructional formats would provide information to determine the success of each format with regard to knowledge retention levels. Not enough research exists to fully examine whether medical vocabulary can be optimally learned in an online setting.

Learners pursuing careers in healthcare administrative fields must have knowledge of medical terminology in order to succeed in their professions (Brahler & Walker, 2008). In the absence of concrete research evidence to support a correlation between medical vocabulary mastery and medical coding success, the assumption exists that mastery of medical terminology leads to coding mastery (AAPC, 2012). A gap in literature also exists in regards to determining whether there are differences in learning outcomes of online and face-to-face instructional formats of medical terminology and medical coding.

Learners who enroll in the healthcare data technology programs in community colleges take at least one medical terminology course, an introductory prerequisite for all other medically related courses in the program. This course, available in both face-to-face and online instructional formats, provides format options for learners. Questions that require definitive answers are needed to assess student achievement in subsequent medical coding courses when learner performance and knowledge retention levels of medical vocabulary in both formats vary and when learning preferences or other factors influence these differences.
Online instructors face the challenge of designing and/or presenting course content that encourages learners to interact with the course materials, classmates, and the instructor. Intrinsic and extrinsic factors such as aptitude, motivation, content design, self-efficacy, learning preferences, family responsibilities, and the number of hours devoted to work and study influence how learners learn. Individual learning preferences demand attention when designing instructional content for the face-to-face venue or online Web-based courses (Pentina & Neeley, 2007).

Determining the levels of medical vocabulary knowledge retention in both online and face-to-face instructional settings provides a basis for examining learner success in procedural medical coding. If differences in student learning outcomes based on instructional format and in the levels of medical vocabulary knowledge retention are discovered, this study will benefit instructors and curricula specialists alike as programs and course content are addressed. The healthcare data technology program proportionately improves if the evidence supports strengthening the program curriculum and provides tangible proof for the need to increase medical vocabulary knowledge retention for all healthcare data technology learners. Learners in healthcare data technology programs realize additional benefits through continued terminology study aimed at improving their existing medical vocabulary. The healthcare field benefits from the availability of potential employees who possess medical coding expertise.

Delimitations and Researcher Assumptions

This study focused on the healthcare data technology discipline in a multi-campus southeastern community college setting. Inferences to other educational disciplines, however, may be drawn with respect to course design and learning outcomes. Identifying
levels of knowledge retention and the mastery of skills that are accomplished from previous learning experiences assists instructors and students in applying the knowledge and skills to new experiences. The healthcare data technology program, one of the largest technical programs offered in the community college environment, offers industry training to students enrolled in the program. The diverse group acquires an array of skills and factual knowledge and utilizes various instructional approaches to learning to achieve success in the program.

Participants, therefore, possessed the knowledge to complete the questionnaire and offer opinions regarding instructional format and success in the required courses, supporting the assumption that the participants could read, understand, and respond honestly to the questionnaire. A further delimitation was the potential for error in extracting and assigning the data to the participants through the use of student-generated codes.

Although the researcher is an employee of the community college where the study took place, teaches face-to-face and online classes in the healthcare data technology program, and has a professional association with the learners involved in the study, participants’ anonymity was assured by utilizing student-generated codes that correspond to the data. The researcher enlisted the aid of an assistant who explained the study to potential research participants, provided a consent form that represented all aspects of the study, and collected and stored the data until identifying elements were removed. The data was then transferred to the researcher who analyzed and examined the data.

The researcher assumed that each participant in the study would respond to the statements on the questionnaire honestly and would also complete the medical
vocabulary test with maximum effort when the test was re-administered in the subsequent courses. This study highlighted the participants and their performances in online and face-to-face medical terminology courses to determine any correlation between vocabulary mastery and coding mastery.

Definition of Terms

To ensure understanding and usage of concepts and terms in the research study, the following definitions clarify explicit meanings and context utilized in the study.

Assessment: Measurement of learning; utilization of instruments to determine learning proficiency.

Adult Learner: A mature, nontraditional learner involved in formal education and/or training. Typically, the adult learner balances employment and family responsibilities while completing courses.


Certified Medical Coder (CPC): The designation assigned to a member of the American Academy of Professional Coders organization when the individual passes a national certification examination administered by the organization.

Electronic Healthcare Records: The digital format of medical records with the intent of sharing them across healthcare settings via the Internet. The creation of EHRs results in the accurate documentation and maintenance of healthcare services and patient information.
Healthcare Data Technology (HDT): A two-year technical program at the community college level that offers training in medical transcription and medical billing and coding.

Industry Certification: A national certification examination process that ensures basic understanding of industry-specific skills and knowledge and is generally required for employment in many healthcare facilities.

Industry Credentials: Certification acquired by passing national certification examinations.

Knowledge Retention: Factual information regarding specific course content that is retained after the course has ended and that can be applied to future learning modules.

Learner Preferences: The learning method by which an individual prefers to assimilate information; the common modalities include kinesthetic, auditory, and visual preferences. While no one preference dominates the learning process, an understanding of content design that addresses unique learner characteristics helps to ensure that information is absorbed.

Medical Billing and Coding: The translation of medical diagnoses, procedures, or services into a numeric nomenclature for the purpose of receiving insurance reimbursement for physicians and facilities.

Medical Vocabulary Retention: The ability to remember medical vocabulary and apply the understanding of body system terminology to healthcare situations.

Online Communication: An avenue of interchanging ideas, information, or discussion between instructor and students or between students and other students using emails, chat rooms, discussion forums, and blogs.
Summary

The focus of Chapter I addressed the continued growth and appeal of online courses and how to determine the proficiency of student learning outcomes. The purpose of this study relied on establishing whether knowledge retention in medical vocabulary courses correlates with student achievement in related medical coding courses based on instructional format. Investigating the influence of other factors helped to determine the potential influence on learning outcomes.

Chapter II includes a relevant literature review including online versus face-to-face instructional formats, characteristics of the instructor and learner, the study’s theoretical framework, and related issues affecting student learning outcomes and students’ choices of instructional format. Chapter III describes the research methods of this study, including the research setting, description of the participants, the statistical design used for data analysis, instrumentation, and data collection and analysis. Chapter IV presents the research results for the one research question and three research hypotheses. Chapter V provides a discussion of the research study, including methods and procedures, conclusions, limitations, implications, and researcher recommendations.
CHAPTER II
REVIEW OF RELATED LITERATURE

This chapter presents the following eight sections of literature that sustain the relevance of the study: (1) research addressing the background and supporting the theoretical foundation of the study; (2) instructional learning theories, including cognitive, behavioral, and constructivist learning paradigms; (3) the community college role in career and technical training; (4) distance learning through online instruction including a definition of distance learning, distance learner profile, and globalization leading to distance learning; (5) online instructional design that focuses on learning effectiveness, technology, and factors affecting learning outcomes such as communication, motivation, self-efficacy, learner satisfaction, and learner preferences; (6) adult learning theories and characteristics of the adult learner and teachers of adults; (7) learning outcomes and knowledge retention, specifically addressing medical vocabulary and medical coding mastery; and (8) training methods for medical billing and coding specialists and learning industry-specific vocabulary.

Theoretical Framework

Medical vocabulary is required before learning how to assign medical procedural codes to patient cases. The application of the basic facts of medical terminology to coding ability led this researcher to the theoretical framework of this study. Students enrolled in the healthcare data technology program chose the program because of an interest in working in the healthcare arena and must learn the medical language to continue in the program. The total program builds on the factual information found in the medical terminology courses and proceeds through the advanced application in coding. Therefore, Dewey’s (1916) philosophy of knowledge acquisition and application,
Bandura’s (1995) views of attention, retention, application, and motivation in acquiring and transferring knowledge, and Vygotsky’s (1978) constructivist learning paradigms have direct bearings on this researcher’s study.

Dewey, Bandura, and Vygotsky

The learning philosophy of Dewey (1916) serves as a theoretical underpinning of the design and examination of this study because he asserts that the acquisition of skills is a commendable goal of education; however, the greater good results from the application of those skills. Stressing the importance of effectively providing instructional content based on learners’ past experiences and learning, Dewey (1916) suggests that learners are then more deeply connected to the new knowledge presented. He further advocates an educational structure that balances content delivery with the student’s interest and one that encourages the instructor to become a partner in the process. A hands-on, authentic approach to learning has evolved to guarantee that learners actively participate in their own learning outcomes; thus, cognitive constructivist pedagogies have emerged as a result of this approach. Vygotsky (1978) advocates social constructivism paradigms when engaging the learner. Through active learning, students use their experiences to construct a knowledge base for relevant situations.

The applicability of Bandura’s (1995) learning paradigm—attention, retention, reproduction, and motivation—to the acquisition and retention of information learned in courses yields foundational knowledge necessary for subsequent related courses (Cherry, 2011). The learner who possesses self-efficacy pays attention to the learning situation, stores available information, performs skills through practice, and exhibits motivation to activate the knowledge. The learner’s motivation to succeed leads to the
processing of higher-level cognitive skills resulting in the attainment of information when
transferred to related situations. Through constructivist learning, learners think
independently as they interact with instructors and peers during the exploration of areas
of interest designed to ensure pragmatic learning.

Including cognitive, behavioral, and constructivist paradigms in the instructional
content for medical terminology and medical coding ensures that appropriate learning
takes place. Behaviorist learning paradigms address sequential, lower-level learning such
as memorizing and retaining medical vocabulary, while cognitivism promotes
understanding the thought process behind the behavior that equates with applying the
medical vocabulary to understanding the medical coding process. Constructivist methods
produce active and reflective thinking as knowledge is constructed and applied to
authentic learning. Transformational learning combines reflection and critique of
understanding concepts that include tolerance for differing views and opinions, a concept
that is prevalent with adult learners who bring multiple experiences to the learning arena.
The complexity of medical coding necessitates multiple learning ideologies because of
the progression from basic knowledge to skill development to application of skills and
understanding.

*History of Learning Philosophies*

The accelerated rate at which the world changes and evolves through global
interdependence, genetic engineering, information superhighways, and innovative
technologies impacts every aspect of people’s lives. Therefore, educating today’s student
requires new approaches rather than *business as usual* as they prepare for increasing
challenges in society and the workplace.
For centuries, philosophers have tried to explain the human mind. René Descartes thought that only the physical body could be studied scientifically; John Locke emphasized that environmental sensations produced ideas; Immanuel Kant believed that concepts developed from time and space and could not be reduced to simpler elements (Vygotsky, 1978). The higher psychological processes—thought, language, and conscious behavior—were neglected and mostly questioned as to their existence (Vygotsky, 1978).

By the end of the twentieth century, Vygotsky appeared on the scene and disagreed with the prevailing thought of the day. Instead, he proposed a comprehensive approach that not only describes higher thought processes but explains their functions, becoming “the foundation for a unified behavioral science” (Vygotsky, 1978, p. 6). He believed that an enmeshed culture resides in a person’s nature and that the brain controls and produces psychological functions, a belief that added credibility and continued significance to his work. Dewey espoused the importance of thinking and of developing the mind, advocating the need to develop effective habits of discriminating “tested beliefs from mere assertions, guesses, and opinions” (Dewey, 1910, p. 28). He stressed that individuals develop habits of inquiry and examination and not accept everything as truth. Dewey (1910) believed that training the mind involved curiosity, suggestion, and orderliness, and that curiosity entices the learner to crave knowledge.

**Commonalities in Theories**

A common thread that pervades the views of many scholars ensures that students are educated to live and work productively in society (Bandura, 1995; Dewey, 1910; Fullan, 1993). Through communication exchanges within society, individuals share
experiences that become commonplace, and as societies become more complex, the need for teaching and learning increases (Dewey, 1916). Individuals interact with their social environment to form mental and emotional behavioral characteristics (Dewey, 1916). Shared experiences within society help to initiate the learning process by building on previously learned ideas, concepts, and skills.

Dewey (1916) viewed education not only as the “social continuity of life” (p. 4), but specifically as a necessity of life, a social function, a direction, and a growth for the individual involved in the process. Communication among the members of society creates a community of learners who form integral relationships to maintain the group; all communication is thus educative. As civilization advances and the gap widens between the young and old in a group, formal education by trained instructors becomes necessary in order to transmit knowledge of more advanced occupations (Dewey, 1916). The healthcare data technology student, for example, must learn a complicated new skill set while developing the ability to work in the healthcare environment that is complex and under governmental scrutiny.

Vygotsky’s position regarding learning mirrored the thoughts of Dewey, who espoused the involvement of experience and thinking in learning. When humans experience something, they also “act upon it, do something with it, and then suffer or undergo the consequences” (Dewey, 1916, p. 77). In educational contexts, experience equates to an active-passive affair that involves some cognitive ability, yet the measure of the value of the experience lies in the relationships, meanings, and applications that occur (Dewey, 1916). Experience then is the thought process, the associated action, and the consequences that follow. Dewey (1916) asserts that when learners reflect on their own
experiences, a relationship or connection exists between the attempted action and what happens in the consequences. The thinking aspect of understanding an experience involves risk. As Dewey (1916) explained, certainty cannot be guaranteed in advance; therefore, the unknowns become an adventure of discovery and learning.

Contrary to popular views during this period that teachers impart instruction, Vygotsky (1978) understood the need for students to assume an active role in their learning. His social constructivist theory of learning had three major themes: (1) social interaction plays a fundamental role in cognitive development, (2) learning is a reciprocal experience where individuals (peers or teachers) with more knowledge instruct the learner, and (3) the student develops the ability to solve problems independently after guidance. Vygotsky believes that children and adults learn in social settings. His views provide the foundation for connecting individuals in social learning environments such as distance learning via the Internet and directly apply to educating the healthcare data technology student through distance learning courses.

Society is constantly changing as individuals communicate and share information with distant groups. The statement, “People’s beliefs in their personal efficacy to manage the demands of rapidly changing societal conditions help them to meet these challenges” (Bandura, 1995, p. vii), emphasizes today’s relevance of Bandura’s views regarding healthcare data technology education. He further advocates the acquisition of cognitive, behavioral, and self-regulatory tools to manage life’s changes. People structure their beliefs concerning their personal efficacy as a result of mastery experiences—successes build a robust efficacy, and failures undermine efficacy (Bandura, 1995).
Dewey (1910) suggests that thinking and learning occur by bridging gaps in experience and putting isolated facts and deeds together—perhaps the precursor of constructivist learning methodology. The “secret of growth and development is learning how to contend with the forces of change” (Fullan, 1993, p. vii), an obvious concern in the present world where change is constant. Fullan (1993) asserts that an individual adapts to continuous change by becoming an inquirer and learner, by developing generative concepts and capacities, by exhibiting team work as well as individualism, by demonstrating leadership characteristics, and by encouraging others to lead. This view substantiates today’s educational responsibilities of training healthcare students for employment in the digital environment and for working cooperatively with others.

Specific to healthcare data technology programming, the human mind acquires fundamental medical vocabulary knowledge and applies the information to job-related coding skills as purported by Dewey. Bandura and Dewey saw the whole being and the impact that learning has on the development of the total individual. Vygotsky’s views support self-responsibility in learning by establishing the basics for online learners and providing an understanding of today’s adult learners. Dewey, Bandura, and Vygotsky related applicable learning modes that are directly appropriate to healthcare data technology students today.

Instructional Learning Theories

Learning is a lifelong process, and both successes and failures are instrumental in creating opportunities and experiences for learners. Numerous studies address the complexity of learning and how learning takes place. The intricacies of learning parallel the human’s cognitive, physical, social, and psychological makeup, and scholars argue
that one learning theory fails to encompass all intelligences and abilities of today’s
learners, who face historic technological change (Mergel, 1998; Ranson, Martin, Nixon,

As deficiencies in one theory surface, another theory becomes popular, resulting
in an overlapping of views and concepts that lead to incorporating components of each
task into the learning process. Adapting theories to projected learning outcomes, based
on learner characteristics, results in the mastery of basic skills, application of knowledge,
and acquisition of expertise (Mergel, 1998). Quality educative processes that incorporate
proven teaching paradigms expose the learner to instructional content and materials
designed to elicit mastery.

While no one instructional theory solves all learning issues, three well-known
theories—Behaviorism, Cognitivism, and Constructivism—constitute the basis for other
learning theories and produce positive learning outcomes when applied appropriately to
the situation (Mergel, 1998). Established learning techniques evoke responses to
questions and ideas that cause learners to achieve content mastery and understanding.
These three theories support the process of learning the basics of the medical language
and its application to the more complex process of medical coding.

Behaviorism

The behaviorist school of thought, founded by Skinner, measures observable
learning based on reinforcement during the learning process (Bradley, 2011). This
thought process focuses only on the behavior, not the mental process. Proponents of
behaviorism propose the following assumptions:
• Learning by change in behavior produces an external change rather than an internal thought process.
• The environment shapes behavior, not the individual.
• Contiguity (closeness of two events occurring) and reinforcement (repeated practice) yield automatic behavior. (McLeod, n.d.; Mergel, 1998)

Theoretically, the behaviorist approach seeks a response following a stimulus, and repetition or practice produces the desired responses. The principle of behaviorism depicts a concept where reliable and predictable responses transpire. If a stimulus necessitates a behavioral response, one could argue that appropriate stimuli in educational settings induce the desired response, thereby placing the burden of learning on the teacher rather than the learner (McLeod, n.d.).

Behavioral theorists compare the mind to an empty vessel waiting to be filled with information. The behaviorist approach supports the learning of memorized facts and information such as the medical language, suggesting that time devoted to learning lower level skills and facts prevents learning higher levels of knowledge. The behaviorist learning approach incorporates objective assessment, assuming that learning is passive and that all learners absorb the same information without formulating new concepts or constructs (Learning Theories Knowledge Base, 2009).

Advocates of the behaviorist learning theory focus on its basic characteristics—systematic and structured learning from clear goals and objectives, sequential lower level learning opportunities and memorization, individualization of instructional strategies, objective testing that elicits responses to stimuli, and anticipated results from teacher-directed methods (Technology Matrix, 2003). Opponents argue that behaviorism cannot
account for all learning because this theory discredits the mind’s activities and abilities and does not take into account complex learning such as medical coding (Funderstanding, 2008; Johnson, Miller, Murphy, & Shafer, n.d.). As a result of this opposing view, theorists began to explain learning from the standpoint of cognitive abilities.

*Cognitivism*

When certain behaviors could not be clarified, cognitivism emerged as the basis for explaining the thought process behind the behavior. Cognitivist proponents contend that this expanded view of learning involves the reorganization of experiences from the environment in order to make sense of the stimuli that elicits behavioral responses and that basic knowledge is necessary in order to process new information (McLeod, n.d.). From the standpoint of the healthcare data technology student, this explanation of learning can be aptly applied to medical vocabulary acquisition and subsequent transfer to the coding process. Cognitivism is learner-focused, initiates an active learning process, and results in higher level learning opportunities that have a longer impact on the individual and society (McLeod, n.d.).

The underlying assumption of cognitivism is that learned behavior is a result of the mental process of assimilating information. Gaining prominence in the 1950s, this concept continues to influence today’s instructional design models. The cognitive view prevails when certain behaviors cannot be easily explained, for example, social behaviors of children who do not imitate all behaviors to which they are exposed yet can model the behavior of others (Mergel, 1998).

The transition from behaviorist to cognitivist thinking occurred seamlessly because both views support objective knowledge as the fundamental learning structure.
leading to smaller segments of learning (Mergel, 1998). Constructivists see the learner as an information processor, a thinking and reacting being who interacts with his or her environment in order to learn (LTKB, 2009). When constructing a foundation for future learning, humans collect information, concepts, and experiences that are unique to each.

Bloom’s learning domains—cognitive (knowledge), psychomotor (skills), and affective (attitudes)—continue to blend with modern learning viewpoints (as cited in Weston & Cranton, 1986). In the cognitive domain, students react and respond to multiple levels of learning (Weston & Cranton, 1986). At the lower levels of learning the medical language, learners experience information processing, concepts, values, and instructor-oriented methods rather than interactive materials. At the application and analysis levels, healthcare data technology students develop their own thinking and reasoning skills through interaction and participation in new situations. At the highest learning levels, these students process complex information and perform work-related tasks with limited instructor assistance.

Practice in a learning environment leads to mastery of skills. In the psychomotor domain of learning, instructional strategies and materials include the opportunity for repeated performance of activities because mastery of skills is not possible by reading alone (Weston & Cranton, 1986). Learning is difficult, if not impossible, to measure accurately because it is an internal process. Assessment of learning takes place using evaluative methods; however, in the affective domain, the exact impact of learning lacks total understanding (Weston & Cranton, 1986). Mergel (1998) concludes that the application of cognitive learning to initial learning, such as improving thinking skills and completing routine tasks, serves as one of the best theories for developing problem-
solving skills. The ability to assess a student’s medical vocabulary knowledge retention is a complex issue; however, this issue needs to be addressed in terms of the impact on the development of medical coding skills.

**Constructivism**

Constructivist learning had its origin in Piaget’s and Dewey’s learning perspectives, emphasizing the development and creation of learning concepts through the learner’s active and reflective thinking (Ruey, 2010). This dynamic and interactive concept of learning has gained attention in the educational arena in recent years. The student is the center of learning, and the teacher directs the learning as individuals construct knowledge based on their unique experiences (McLeod, n.d.). Learning, according to this school of thought, cannot be exchanged between one learner and another learner because each learner creates or constructs his or her own learning. Instructional designers are to consider the learners’ prior knowledge, interests, and understandings when framing the learning environment (McLeod, n.d.).

Emphasis on the collaborative search for new knowledge and the cultivation of learning environments exists in constructivist learning settings where harmonious interaction among students, materials, concepts, and instructor transpires (Kaufman & Brooks, 1996). Vast philosophical differences exist between behaviorism and constructivism; however, cognitivism and constructivism share similarities because constructivist learning requires cognitive abilities (Mergel, 1998). Fundamental differences distinguish behaviorism and constructivism; constructivists attach greater significance to experiences, contradicting behaviorist views that lean toward skills
identification as more important. The art of mastering the medical language relates to cognitive abilities, while learning medical coding supports constructivist methodology.

Through constructivist learning opportunities, learners choose unique paths of discovery even when assessment of their discovery may be impossible or too abstract to measure. Self-directed, higher levels of learning are the norm in constructivist instructional settings. Kaufman and Brooks (1996) recognize the strengths of constructivist learning through opportunities for reflection, peer and self-evaluation, project demonstrations, critical thinking, and discovery-based learning. Social constructivism, according to Vygotsky’s beliefs, enables learners to construct knowledge through self-reflection and continuous interaction with others (Ruey, 2010). Learners absorb and memorize information in behavioral learning, process information in cognitive learning, and experiment with information in constructivist learning. Burney (2008) asserts that success in learning, irrespective of instructional design theory, depends to a great extent on learner characteristics, including but not limited to self-efficacy, innate motivation, personal choices, beliefs, and students’ thoughts and feelings.

Learning includes dynamic, complex, and multivariable processes; therefore, Mergel (1998) advocates that learning theories be adapted to desired learning outcomes based on learner characteristics required for skill mastery, knowledge application, and course content proficiency. Furthermore, humans are social creatures, and learning is dependent on interaction with the community of learners, expectation of others, and internal motivation (Ranson et al., 1996). As instructional opportunities undergo tremendous changes as a result of emerging technologies and online instruction, these theories of learning will continue to provide the basis for modern instructional design.
The healthcare data technology student enters the program with limited or no medically related vocabulary. The cognitivist/behaviorist merged view assures that within the timeframe of the program a student’s knowledge and understanding transitions from minimal to advanced proficiency as factual information is poured into minds that are primed for learning. Under this premise, healthcare data technology students can assimilate the medical language and then develop competencies in the medically related courses that build on the foundation of medical vocabulary understanding. As choices of face-to-face or distant learning classrooms continue to exist for students in the healthcare data technology area, the development of independent, motivated, and socially adept learner characteristics ensures successful learning outcomes.

Community College Role in Learning

Career and technical education (CTE) is a system offering workforce training, skills development, and industry validated standards in partnership with business and industry. The mission of career and technical programs concentrates on training students for occupations. Upon completion of the training, students enter the workforce or continue their education at the university level. The transferability of earned technical credits varies among the institutions based on state policies and majors. Successful completion of career and technical programs depends upon a number of variables. Community college students “are typically older, employed, have dependents at home, have interrupted their education, are female, have varied personal and work schedules, and bring a variety of life and work experiences” (Huang, 2002, p. 27) to the learning situation. Community colleges boast the highest growth rate and account for over one-half of all online enrollments (Allen & Seaman, 2007).
Theorists of instructional design recognize the differences between students seeking academic majors and those pursuing occupational associate’s degrees (Hirschy, Bremer, & Castellano, 2011). In studies cited by Hirschy et al., CTE students are more likely than their academic associates to be “female, African American, older, married, first-generation college students, financially independent from their parents, working full-time, receiving financial aid, completed a vocational high school curriculum, and have a postsecondary 3.5 GPA” (2011, p. 298). The students who are enrolled in the healthcare data technology program in community colleges exhibit these traits.

Community colleges receive nationwide recognition for their responsiveness to workforce needs (Davis, 2008). The latest available 2007 statistics from the U. S. Department of Education (2012) indicate that 253,417 of 835,070 awards and degrees conferred at two-year public institutions were associate career/technical education degrees. Students in the healthcare administrative services area alone earned 3,799 associate degrees.

Strong links between community colleges, business, and industry enable the community colleges to address community workforce needs as they arise, thus becoming catalysts that attract new businesses into an area. Nevertheless, community college career and technical programs face increasing challenges to provide industry-specific credentials and program validation. Healthcare data technology graduates may obtain certification in a number of areas that indicate their proficiency. While not required by all healthcare entities currently, certification may be mandatory in the near future.

Rupert conducted a study that included 64 legislators from 50 states and found that community colleges play significant roles in maintaining the economic stability of
the nation because they respond quickly to their respective states’ business and industry training needs (as cited in Davis, 2008). Rupert cautions, however, that continued business and industry validation requirements will necessitate proactive programming and instruction to prepare today’s students for the work place. Critical thinking skills and problem solving abilities are *soft skills* that community colleges teach as business and industry continue to turn to community colleges for licensure and certification of potential workers in myriad occupations (Hirschy et al., 2011). In addition to the skill competencies associated with the healthcare data technology field, program completers are required to possess interpersonal relationship attributes, computer knowledge, and the ability to be employed in a diverse and changing workplace.

Students and their communities benefit from workforce training programs in the postsecondary settings when students develop skills and competencies that are necessary to counter unemployment and poverty. Educators are burdened with the obligation to provide training that not only culminates in course success but also in success with job placement. Noncompleters, career and technical students who do not finish the prescribed program of studies, exist in greater numbers than those in academic disciplines. One explanation may be that individuals in CTE programs take only one or two courses of basic training to help increase their employability (Hirschy et al., 2011). However, offsetting the high attrition rate merits the attention of the institutions by addressing the barriers to completion (Hirschy et al., 2011). The healthcare data technology area is no different than other technical programs in terms of high numbers of students who fail to complete. This research study will hopefully provide counter
measures for failure to complete the program by identifying knowledge acquisition methodology of the medical language and coding skills.

Using a number of theoretical models, Hirschy et al. (2011) focus on several models that could be instrumental in understanding occupational student success and program completion in community colleges:

- The Tinto model identifies individual characteristics, expectations, academic motivation, and goal commitment.
- The Bean and Metzner model focuses on students who fail to complete their programs by addressing student persistence and institutional experiences.
- The Bean and Eaton model integrates the student’s positive attitude and high levels of self-efficacy with the belief that success is likely.
- The Swail, Redd, and Perna triangular concept of cognitive, social, and institutional factors interact to form either positive or negative experiences.
- The Nora, Barlow, and Crisp model engages students and institutions after the first year.
- The Braxton model responds to Tinto’s original model, suggesting that commuter institutions fail to support his elements, thereby identifying student entry characteristics and campus environments as critical components.
- The Reason model interrelates student, faculty, and institutional factors.
  (Hirschy et al., 2011, pp. 300-306)

Reason’s model, according to Hirschy et al. (2011), offers a broader collection of influencing factors on college success than earlier theories. Reason mentions precollege characteristics and experiences, the institution’s organizational structure, and individual
student experience with peers, faculty, and the institution as contributing factors in successful student learning outcomes and program completion. He further argues that multiple interactions between the student and the college environment lead to understanding student success. The community college system provides students with faculty and peer interactions in classrooms with low instructor/student ratios and offers training programs, such as healthcare data technology that meet the community employment needs. Within the context of the healthcare data technology program of studies, the student completes courses related to medical vocabulary, medical diagnosis and procedural coding, medical insurance billing, medical database management, and administrative office management, plus an academic core that includes courses such as English, math, economics, and accounting.

Distance Learning Via Online Instruction

While distance education may seem to be a relatively new idea to educators and students today, distance learning had its origins in correspondence studies in the 1830s. Educational use concurrently developed with technology associated with radio (in the 1920s), television (in the 1930s), and satellite (in the 1960s) communication. Instructional television appeared in the 1980s. Fiber-optic communication systems, available in the 1990s, made possible two-way audio and video interactive distance education (Simonson, Smaldino, Albright, & Zvacek, 2009).

With the advent of the Internet in the 1990s, computer-facilitated learning connected learners and educators without regard to time or place. No longer confined within physical spaces and certain time frames, instructional formats delivered at a distance allow learners to eliminate or reduce travel to and from educational institutions.
The delivery of learning transcends the conventional classroom to a broader context of knowledge delivery, providing instruction when and where the learner prefers. The popularity of distance learning continues to play a role in institutional goals and strategic planning. The healthcare data technology program offers the majority of its courses in the online classroom. Students have the choice of instructional format, and their reasons for selecting the online classes vary from work related issues to childcare and transportation concerns.

Defining Distance Learning

Fundamentally, the characterization of distance education equates with the separation of teacher and student; however, geographical distance, time distance, and intelligence distance additionally describe the learning process occurring via online formats (Simonson et al., 2009). With emerging technology and the Internet, every aspect of separation can be diminished, if not completely eliminated. From an educational standpoint, according to Simonson et al. (2009), distance learning is content and learner centered as a result of multimedia instruction and encourages collaboration through interaction. When fully developed, the concept of distance learning may better define the term “distance” as “interaction” resulting from communication through interaction (Simonson et al., 2009, p. 27).

Many definitions of distance learning exist. However, all definitions include these common elements:

- separation of teacher and student,
- influence of an educational organization,
- multi-media presence connecting teacher to student,
two-way communication opportunities between teacher and student, and
practice of individualized instruction. (Simonson et al., 2009, p. 27)

**Profiling the Distance Learner**

Studies show that individuals who are independent learners, persistent, organized with good time management skills, motivated to learn, and possessed of basic technology skills are good candidates for online courses (Palmer & Holt, 2009). With the continued and increasing demand for online instruction, educational institutions and organizations face challenges to offer quality online instructional programming that guarantees optimum student learning outcomes. Student and faculty interest in distance learning continues today as technology innovations emerge and as other factors influence learners’ decisions to learn at a distance, such as student age, employment status, and annual income (Beqiri, Chase, & Bishka, 2009). The National Center for Education Statistics (2011) of the U.S. Department of Education reports the following statistics:

- In 2007-08, about 4.3 million undergraduate students, or 20% of all undergraduates, took at least one distance education course. About 0.8 million, or 4% of all undergraduates, took their entire program through distance education. (NCES, 2011, p. 20)

- In 2008-09, more than half of the 1.6 million bachelor’s degrees awarded were in five fields: business (22%), social sciences and history (11%), health professions and related clinical sciences (8%), education (6%), and psychology (6%). (NCES, 2011, p. 114)

Research findings also show that student characteristics influenced participation in online courses, with older, married, employed, part-time students, more likely to
choose distance learning than their counterparts (NCES, 2011). Beqiri et al. (2009) studied 240 respondents and discovered the following facts:

- Graduate students are significantly more satisfied with online courses than undergraduate students.
- Students living farther from campus are more satisfied than those living closer to campus with online classes.
- Students who perceive online courses as a suitable way of learning tend to be more satisfied with online course delivery.
- Students who are more familiar with course content tend to be more satisfied with online courses in general. (Beqiri et al., 2009, p. 98)

Ultimately, Beqiri et al. (2009) suggested that online graduate courses, courses that attract more males, familiar courses (not core or prerequisite courses), and blended course-delivery modes may be better received by students.

In 2011, some 55.5% of 2,512 United States higher education institutions responded to a survey conducted by the Sloan Consortium (http://sloanconsortium.org/) regarding current trends of online education in their facilities. For the purpose of the study, the researcher defined online courses as those with at least 80% of the course content delivered online, and face-to-face courses as those with zero to 29% of the content delivered online. The sample included 80% of the universal sample because the institutions who responded were the ones with the larger enrollments. The Sloan Consortium merged the 2011 responses with the data from 2003 to 2010 and publicized the following findings:
• Sixty-five percent of reporting institutions said that online learning was part of their long-term strategic plan.

• Between 2003 and 2010, online enrollments grew substantially faster than overall higher education enrollments.

• Over 6.1 million students were taking at least one online course during the Fall 2010 semester, an increase of 563,000 students from the previous year.

• In 2010, 31% of all higher education students took at least one course online, an increase from 10% in 2002.

• Sixty-seven percent of academic leaders gave online learning outcomes a superior rating when compared to face-to-face learning outcomes; one-third of all academic leaders continue rating online learning outcomes inferior to face-to-face instruction.

• Annual growth rate of online enrollment is 10%, lower than in any year since 2002, but the student base is larger than ever; online enrollments will continue to grow.

• The upward rise in online enrollments may be approaching a plateau. (Allen & Seaman, 2011, pp. 4-12)

Allen and Seaman (2011) indicate that the academic leaders at institutions with online courses may be more apt to rate online course delivery more favorably regarding learning outcomes than their counterparts who have no online courses at their institutions. They further report equivalent student satisfaction ratings for online and face-to-face courses, with slightly superior ratings for student-to-faculty communication in face-to-face instruction, and far superior student satisfaction ratings for student-to-student
communication in face-to-face instruction. Understanding how to improve students’ online performance in medical terminology increases the chances for optimal content mastery and successful outcomes of the healthcare data technology program.

The globalization of society leads to the continuous presence of individuals on the Internet as they conduct business, network socially, game, and learn. Learners want flexibility with courses, opting when and where to learn. Interactive technologies make various modes and times of delivery possible and also provide flexibility of format, content, goals, needs, and skills (Rutherford & Kerr, 2008). The broader circulation of ideas and thinking through multicultural interactions tends to promote increasingly multicultural teaching and learning environments (Rutherford & Kerr, 2008). Learning is a dynamic environment that must be designed to meet individual student needs wherever they choose to learn.

Online Instructional Design

Obviously, distance learning is here to stay, and regardless of arguments against this learning platform, distance learning works. When designing course content for the healthcare data technology student, the following provisions can ensure the effectiveness of online instruction:

- providing teachers with helpful instructional strategies,
- designing the content before instruction begins,
- visualizing ideas and concepts during the design phase,
- providing the distant learner with access to resources and support services,
- ensuring teacher-student and student-student interactions, and
• creating assessments that relate to specific learning outcomes.

(Simonson et al., 2009, p. 9)

When designing course content for face-to-face or online delivery, instructors need to remember that outcomes should be comparable although dissimilar delivery platforms are created. Designers should keep in mind that similarities exist between online and face-to-face instructional settings (Simonson et al., 2009). Instructional theories, however, often segregate the two instructional formats as fundamentally different (Simonson et al., 2009). Regardless of the differences in each, instruction is to be designed to create like experiences for the local and the distant learner.

Furthermore, as in all formats of instruction, distance learning programs require planning and organization, with the planning phase receiving the greatest emphasis (Simonson et al., 2009). Focal areas to be considered when designing online courses are instructional content, the nature of the learner, the process by which learning occurs, and the assessment of the learning experience (Simonson et al., 2009). Identifying learner characteristics helps the instructor determine preferred methods of content delivery, activities that promote interaction, formative and summative content assessment, and satisfaction levels of learners with the course design. The characteristics of the instructor will determine whether the learner or the instructor is viewed as the central figure in the learning process (Simonson et al., 2009).

Educational institutions and faculty feel pressured to offer online courses because of the distance learning trend. Successful transition to online delivery occurs by paying attention to course development, delivery, and evaluation (Boerema, Stanley, & Westhorp, 2007), as well as designing instructional content that addresses the autonomy
of the learner and the need for interaction and communication between all parties involved (Simonson et al., 2009). Trained and qualified faculties and administrators who focus on student achievement are vital to ensure that educational goals are established and attained. In academic and technical programs, including healthcare data technology, instructors are encouraged to develop online courses to compete with other institutions and provide alternatives to the classroom and fixed scheduling. Students who are accustomed to on-demand information and Internet social media also desire to have courses available at any time and any place.

*Effectiveness of Instruction*

The popularity and steady increase in online courses persist in spite of the continuing debate about the effectiveness of online learning. Although substantial research indicates that no appreciable differences exist in online and traditional student learning outcomes and effectiveness, the quality of online courses continues to be the subject of debate because of the rapid growth of Web-based instruction (Bradley, 2011; Johnson & Aragon, 2002). Boerema, Stanley, and Westhorp (2007) assert that significant implications for delivery of online learning create learning opportunities that are relevant, applicable to students’ interests and experiences, collaborative, and linked to sequential assessment. In determining the scope of online delivery of courses, the following factors persist in educational discussions:

- deciding whether to incorporate a broad range of topics or a more in-depth approach with fewer topics;
- determining how to arouse students’ curiosities and engage them in the learning process;
• guaranteeing the relevance of learning activities, including assessment as part of the learning process; and
• ensuring collaboration and peer critique. (Boerema et al., 2007)

Working with larger numbers of students in an online course compared to its traditional counterpart creates unique managerial issues as well. Managing discussion groups, collaborative projects, and providing authentic assessment are concerns that merit attention. Boerema et al. (2007) suggest subdividing the larger group into more manageable smaller groups and providing collective feedback to discussions; however, ensuring that students feel supported in their learning and providing the discussion feedback in a timely manner cause some concern.

The design and delivery of online classes pose instructional challenges which necessitate the incorporation of proven strategies for content presentation. Simply converting a traditional format to online format is not the answer. Accounting for individual differences begins with communicating with each learner and ensuring that all students feel that they are part of the group rather than being isolated. Motivating online students to complete assignments and participate in collaborative projects positively correlates with successful student learning outcomes. From the inception of online course delivery, community building, collaboration among learners, and enhanced communication merit discussion (Johnson & Aragon, 2002).

Pedagogically sound instruction results in high quality content delivery. Instructors recognize several factors that produce significant learning:

• Occupational training requires authentic and relevant activities.
• Prior knowledge leads to sequential learning.
Engaging and authentic tasks lead to learning achievement.

Collaborative learning is a social event that motivates students in learning and promotes optimal achievement. (Boerema et al., 2007)

Learning activities in online courses need to be challenging enough but not so difficult as to be overwhelming or unachievable (Boerema et al., 2007). Educators are urged to balance the nature of learning tasks that ensure quality teaching and learning in online environments with their allocated workload. International business, educational opportunities, and emerging innovative technologies continue to challenge distance learning design and delivery.

Instructors design and develop online courses that include innovative ways of facilitating interactive and student-centered active learning rather than duplicating a traditional course (Johnson & Aragon, 2002). Johnson and Aragon emphasize that “interactivities among the learners can result in community building, collaboration among students, and enhanced communication” (2002, p. 2), aspects which are indicative of social constructivist learning paradigms. Assessment of online instructional success begins with accountability of course goals, objectives, and activities, the effectiveness of the course content, the impact or difference the course made for the learners, the organization of the course, and the unanticipated consequences of the course (Simonson et al., 2009). Student achievement in online and face-to-face courses requires attention to all aspects of instruction, including allowing for individual preferences and planning for transfer of basic information to workplace applications.
Clark asserts that no significant difference in achievement and learning effectiveness through the use of media in online courses exists (as cited in Simonson et al., 2009). The incorporation of media and technology, however, enhances instructional delivery in online and traditional face-to-face courses. The use of technology without proven instructional strategies has little impact on the complexion of traditional educational course design; however, the Internet and innovative technologies support online learning and have the potential to alter the online environment.

Technology alone has little influence on student learning, but the interwoven use of technology with dynamic instructional content can empower the course design in online and traditional settings. Connecting technology integration with content goals and course objectives leads to greater learning outcomes while ensuring total implementation.

Huijser (2008) contends that Web 2.0 tools and social networking sites offer endless possibilities in instruction when incorporated with sound pedagogical principles. Multi-generational users embrace emerging technologies, and as distance learning in higher education attracts more students, the incorporation of these technologies provides the potential for new ways of communicating and collaborating. Web-based tools of the latest generation are highly participatory, promote interactivity, collaboration, networking, and content sharing, and include blogging, wikis, podcasting, social bookmarking, social networking, and virtual worlds (Simonson et al., 2009). The perceived value of technology and its effectiveness in learning and task performance are major factors in the acceptance of new technology (Xie & Ke, 2011).
Perhaps one of the most valuable aspects of Web 2.0 technology is its collaborative nature, which allows student-student and student-instructor interaction. Collaboration promotes thoughtful learning experiences, prepares students for the information-age workplace, and ensures better responses than individual efforts produce (Alden, 2010). The public nature of social networking sites poses threats, yet offers opportunities for users to experience global connectivity. Members of social networks utilize the power of networking by gauging opinion, spreading information, and organizing meetings and discussions, a form of collective action, according to Ellison, Lampe, and Steinfield (2000), and these components of the social network can enhance educational experiences in similar ways.

Distance learning, recognized as a mainstream instructional format, occupies a place of prominence as a viable alternative to traditional classes at accredited postsecondary educational levels. The virtual environment of online classes attracts a multitude of learners. Robinson and Doverspike (2006) propose that institutions and faculty would do well to understand why students choose one learning environment over another one in order to develop strategies to eliminate perceived barriers to learning. Learner attitudes, perceptions of potential for successful course completion, opinions of peers and family regarding online instruction, and perceived degree of technology proficiency are factors that influence students’ decisions to enroll in online courses (Robinson & Doverspike, 2006). Understanding how the healthcare data technology student learns and interacts with course materials helps to ensure quality course delivery of medical terminology, thus providing increased opportunities for achievement of basic facts.
Factors Affecting Online Learning

Palmer and Holt (2009) cite studies that provide evidence that student learning outcomes are positively correlated to learner satisfaction. Therefore, an understanding of these factors by course designers can help them design appropriate learning environments that support targeted student learning outcomes. Indicators of student satisfaction in wholly online learning units include “satisfactory and frequent communication, understanding the requirements to succeed in the course, students’ opinions of their own performance, clarity and relevance of assignments, access to campus-based resources, and availability of technical support” (as cited in Palmer & Holt, 2009, p. 102).

Palmer and Holt (2009) also found in a meta-analysis of recent literature that students recognize personal characteristics that hamper or increase the difficulty of successfully participating in online learning—lack of commitment to active learning, inability to self-motivate, difficulty in prioritizing, and waiting until the last minute to complete assignments. Instructors and course designers who identify factors that affect learning outcomes and that contribute to student satisfaction provide support and course content structure to enhance students’ satisfaction and influence achievement (Palmer & Holt, 2009). Communication, motivation, self-efficacy, satisfaction, and learning preferences are factors that influence the healthcare data technology student’s success in both online and face-to-face educational settings.

Communication. A distinguishing factor between face-to-face and online instructional formats, the method of communication in online environments requires careful consideration to ensure that students feel a sense of community rather than isolation. Communication and interaction between learner-learner and learner-instructor
Online communication occurs as a result of media-supported interaction; however, traditional classroom communication occurs without technological intervention.

Online discussions provide key opportunities for exchanging ideas, exploring new concepts, developing the social interaction skills, expressing opinions, and contemplating the opinions of others. Instructor guidance and peer moderation of online discussions are instrumental in providing timely feedback, initiating discussions to difficult questions, identifying key issues that need to be addressed, and making suggestions for further discovery (Xie & Ke, 2011). Students prefer online communication because teachers respond individually to students’ questions through discussions or emails, whereas responses to questions from students in traditional classes apply to the entire group. Discussion forums, commonplace in online environments, encourage student-to-student collaboration as a result of building on the students’ personal and professional experiences, according to Simonson et al. (2009).

Studies show a strong correlation between interaction and learning (Robinson & Doverspike, 2006; Xie & Ke, 2011). Furthermore, research indicates that students who have not participated in online learning believe that instructor-learner communication is hindered in online environments, although students who have participated in online courses tend to report greater faculty connection through communication (Robinson & Doverspike, 2006). Social constructivist learning theorists believe that learning cannot occur in isolation but rather through interaction and connectivity as learner-learner and instructor-learner develop or expand their experiences.
Motivation. Research on motivation has flourished over the last few decades and has become a topic of interest with regard to student achievement and learning outcomes (Lei, 2010; Maclellan, 2008; Xie & Ke, 2011). Johnson and Aragon’s ARCS Model of Motivation summarizes the following components associated with motivating students to learn:

- Attention (providing a participative environment conducive to learning);
- Relevance (ensuring that course content relates to real-world tasks and student goals);
- Confidence (guaranteeing that students can succeed by achieving the expected outcomes); and
- Satisfaction (determining the students’ levels of approval of the course).

(Johnson & Aragon, 2002, p. 2)

Lei (2010) claims that intrinsically motivated learners tend to develop high learner skills without reinforcements or external rewards and then continue to use the knowledge they acquire. Extrinsically motivated students succeed when rewards or reinforcements (both positive and negative) are present. Evidence supports the belief that intrinsic motivation promotes achievement and learning better than extrinsic motivation (Lei, 2010). Motivation, according to some theorists, is a continuum that ranges from intrinsic to extrinsic motivation and plays a significant role in achievement, but the intrinsically motivated learner “demonstrates increased persistence, copes better with failure, exhibits more positive self-perceptions, and engages in tasks of higher quality” (as cited in Xie & Ke, 2011, p. 919).
Self-efficacy. Educators recognize self-efficacy as an important characteristic of the distant learner and as a factor in developing the personal competencies needed to succeed online as well as in the traditional classroom. A positive self-concept allows the learner to gain confidence and assurance that achievement is possible and to utilize self-directed learning strategies. Studies have shown that students with a high degree of self-efficacy understand the nature of learning strategies and how specific strategies lead to learning (Ying, Huamao, Ronghuai, Yanhua, & Jingjing, 2008).

Learner satisfaction. Palmer and Holt (2008) found that a positive correlation exists between learner satisfaction and quality of learning outcomes and suggest that those involved in distance learning look for ways to increase student satisfaction. The following factors determine students’ satisfaction with online classes: (a) confidence regarding learning and communicating in an online environment, (b) requirements for success in the course, and (c) assessment of their performance in the course (Palmer & Holt, 2008). Students want to experience respect from their instructors and peers in any instructional setting.

Researchers, according to Smith, isolated the following top nine attributes of effective teaching common in both online and face-to-face settings and that led to student satisfaction: “respectful, knowledgeable, approachable, responsive, communicative, organized, engaging, professional, and humorous” (Smith, 2011, p. 1). Respectful was number one for both instructional environments, ahead of knowledgeable. Smith (2011) asserts that instructors’ attitudes toward students play a role in success or failure, but the fact that responsiveness was second on the list of online students seems significant. When students are involved in online classes and are separated from the instructor and
other students, slow responses to discussion posts and emails may elicit feelings of isolation from these distant learners. Smith (2011) suggests shifting the paradigm for online classes from a practice of slow communication to immediate feedback and replies to questions.

*Learner preferences.* Because all learners are dissimilar in the way they approach learning and understand performance tasks, instructors would do well to identify learners’ patterns of thinking and reasoning, to recognize how learners process information, to determine learners’ preferences for processing information, and to understand how past experiences, skills, and knowledge can influence learning (Johnson & Aragon, 2002). Educators can teach better when they understand students’ learning preferences for interacting with and processing information and can be more flexible in course design and presentation (Mestre, 2010).

Although evidence supporting learning preferences is being questioned, the consensus of proponents’ claims that “learners are different from each other, these differences affect performance, and differences should be taken into account by educators” (Riener & Willingham, 2010, p. 33) is true and is recognized by both educators and scientists. Learner differences are more complex than explaining how information is received via the senses. Riener and Willingham make the following assertions:

- The ability, talent, and intelligence of the individual affect learning capacity; some learn easily while some struggle with the learning process.
• Students differ in their interests which in turn motivates their involvement in and commitment to learning; some excel in sports, while others excel in the arts and music, and still others enjoy problem solving such as mathematics.

• Students’ background knowledge varies greatly which influences learning; basic math skills, for example, are critical for success in a college calculus course.

• Some students have learning disabilities that affect their learning; autism, dyslexia, and auditory deficiencies may present obstacles to learning. (Riener & Willingham, 2010, p. 33)

Educators are encouraged to focus on students’ abilities, interests, and background knowledge, rather than catering to learning preferences, and to present the most appropriate content based on the levels of ability, interests, and background knowledge of the particular group of students (Riener & Willingham, 2010).

Educational environments are also exposed to diverse cultures because of international communication and globalization, which affect how learners approach educational tasks. Cultures are deeply rooted in fundamental beliefs, patterns, and values that set each ethnic group apart, creating unique instructional prospects and challenges in online classrooms (Rutherford & Kerr, 2008). Culture and communication are interconnected, often presenting unsuccessful attempts at sharing information or understanding basic directions for assignments and tasks.

The global online environment is becoming increasingly multicultural, posing linguistic problems in online discussion forums and requiring intercultural communication skills for successful student interaction and learning outcomes
(Rutherford & Kerr, 2008). Differences in culture create the possibility of encouraging instructors to find ways to bridge the cultural communication gaps so that learners can bring unique experiences into classroom activities and learn from each other (Rutherford & Kerr, 2008). Agar terms this cultural bonding “a coherent connection of differences” (as cited in Rutherford & Kerr, 2008, p. 68).

Educators who model attitudes of curiosity, sensitivity, openness, tolerance, and respect for individuals from different cultures persuade students to develop similar traits (Byram, 2000). Vygotsky’s social constructivist views support multicultural educational experiences because this theory creates learning contexts based on real-world experiences and social interactions (Rutherford & Kerr, 2008). While not an exclusive theory to address cultural differences, social constructivism is a viable pedagogy. Today’s global society calls for open-mindedness regarding concepts, opposing opinions and views, and unique characteristics of workplace individuals. The healthcare data technology student also fits into this educational design to ensure that diversity in their workplace is accepted and respected.

Comparison of Traditional and Online Learning

Distance learning programs are often disparaged by traditional educators who see for-profit organizations often using untrained or nonexistent faculties, no physical facilities, and administrators who are more interested in financial profits than in student learning outcomes (Simonson et al., 2009). Some proponents of online learning criticize traditional or face-to-face instructional environments as being passive learning environments where individual differences are ignored and problem solving, critical thinking, and higher-order thinking are not addressed (Johnson, Aragon, Shaik, &
Palma-Rivas, 2000). The positive elements of online instruction that target these deficiencies could inherently improve the face-to-face instructional content by actively involving the learner and developing higher-order thinking skills and problem solving.

Lim and Morris (2009) indicate that learning quantity and quality suffer when learners are totally absorbed in technology-based instructional strategies, primarily due to lack of interaction with the instructor, steep technology learning curves, delayed feedback, decreased motivation, and increased procrastination. Integrating instructional support and direction using traditional and blended instructional formats can mitigate the effects of excessive technology-based learning assignments. Traditional and online learning environments can offer high level learning opportunities that include application, synthesis, and integration of students’ learning experiences (Lim & Morris, 2009). The degree of learning involvement, according to research studies, is another variable that predicts students’ satisfaction with online and traditional classes (Lim & Morris, 2009).

An individual’s attitude toward a behavior may be positive or negative depending on previous experiences associated with the behavior. A positive experience for one person may be negative for another. Robinson and Doverspike (2006) assert that attitudes cause learners to make choices contrary to their preferences; for example, a negative opinion regarding computers or the Internet may influence the choice for traditional rather than online classes without regard to course design or ability to master the course content.

Instructors and stakeholders are increasingly interested in accountability of college programs and expect tangible evidence of instructional effectiveness (Lim & Morris, 2009). Lim and Morris (2009) cite studies in which students rate their levels of
satisfaction with courses based on the quality of instructor, quality of learning activity, learning support, and study workload rather than traditional or online instructional formats. These studies have further shown that certain characteristics differentiate students taking traditional or online classes. Online students are typically older, more likely to have a job and family responsibilities, and have longer commutes to university campuses. The flexibility of online classes appeals to an increasingly large number of students who are working on advanced degrees and continuing their educational pursuits.

Healthcare data technology students who are enrolled in community colleges continue to choose online course platforms for courses providing entry level facts and knowledge. The goal of colleges and universities is to provide access to learning through online course offerings in order to encourage continued and lifelong learning. Equality of content, delivery, and learning outcomes in online and face-to-face classes guarantees that student achievement is not based on instructional format but rather on the presentation of information.

The continuous demand from healthcare data technology students for online learning creates opportunities to offer quality courses and to provide every learner with options for personal development and training. Numerous factors involved in online learning provide rich topics for research to determine how online as well as face-to-face learning can be enhanced through a better understanding of concerns that influence learning outcomes. Adults enroll or return to community colleges for a variety of reasons; therefore, adults pose challenges to educators and institutions alike. Whether returning for updated skills, to learn new skills, or to complete a degree, adults bring increased experiences that affect their educational process.
Adults and Learning

Understanding how adults learn is essential in structuring learning opportunities that appeal to their needs. Regardless of differences in various theories of student learning and success, all educators of adults are facilitators of learning. Merriam (2008) informs that educators are better able to structure learning activities that resonate with adult learners when instructors know how adults learn. Opposing views permeate the concepts surrounding how adults learn, yet a commonality is that no one learning theory is preferred (Bear, 2006; Clinton & Rieber, 2010; Merriam, 2008; Rogers & Illeris, 2003).

Rogers and Illeris (2003) had a debate regarding the difference between the way that adults and children learn. Rogers posits that little difference exists, although Illeris believes that adults learn based on motivation, which results in a very different approach to teaching adults. Both agree, however, that equally forced and voluntary learning experiences exist and that motivation, regardless of whether part of the learning or the drive that encourages the learning, is essential in the learning process (Rogers & Illeris, 2003). Adult education requires that adults assume more responsibility for their learning. The range of experience of adult and young learners separates the two groups educationally and psychologically, and Rogers contends that a good portion of learning takes place through social interaction with the teacher (Rogers & Illeris, 2003).

Younger learners may be more accustomed to technology than adult learners and have been labeled tech savvy by many, but their level of comfort may not equate with an intimate understanding of technology use and the critical reasoning and application of technical skills that are associated with technology inclusion in instruction (Huijser,
Learners, regardless of age, are obligated to learn the art of self-expression, to differentiate between different modes of communication, to make appropriate judgments, and to acquire the ability to locate relevant information (Huijser, 2008). With a variety of ages present in the healthcare data technology program at most community colleges, the inclusion of age-appropriate tasks and objectives is needed for all content delivery systems.

**Early Adult Learning Theories**

Early theorists contended that learning is primarily a cognitive process, in which the mind absorbs the knowledge and then appropriate behavior occurs. The current belief is that adult learning is moving toward the context of where learning takes place and that learning is not just a cognitive activity but a multidimensional phenomenon (Merriam, 2008). Bear (2006) and Merriam (2008) advance the position that adult learning is more conducive to transformational learning, which involves reflection and critique and leads to being more open to the perspectives of others and more accepting of new ideas. Transformational learning is immersed in constructivist paradigms that focus on task-oriented problem solving and understanding cause and effect relationships (Bear, 2006). This combination of learning principles provides opportunities to educate adults in the healthcare data technology program as their experiences lead to problem solving in the coding courses.

Transformational theorists espouse that not all learning experiences are transformational, that personal and social changes are inherent to the learning process, and that educators can be instrumental in providing instructional settings that allow teacher-student interaction and respect (Bear, 2006). The focus has “shifted from
understanding adult learning from the individual learner’s perspective to the learner in context” (Merriam, 2008, p. 95), which places the adult in the workplace, a cultural setting, or social environment. Merriam (2008) further asserts that the mental-physical aspect of transformative learning is strengthened through sensory, kinesthetic, and passionate learning experiences.

Adults’ maturation levels and experiences tend to promote independent thinking, rather than receiving passive knowledge, which is a goal of the social constructivist learning method (Ruey, 2010). Sustained learning motivation in adults can result from tailoring course curricula to meet their personal expectations and needs. Ruey (2010) presents the results of research indicating that adults participate in planning goals and objectives for courses, have input in setting their own learning pace, help develop the methodology to achieve their goals, and are encouraged to provide timely responses and feedback when posting to discussion forms or submitting assignments.

Adults as Distant Learners

Online learning provides adult learners with flexible learning opportunities at any time and in any place. Lifelong learning is anticipated due to globalization and enhanced technological updates in business and industry; therefore, online learning offers options for adults who are employed and/or have family responsibilities and are required to return for training or new knowledge acquisition. Actively engaged learners in social constructivist learning environments discuss, argue, collaborate, and negotiate to solve problems through instructor-designed learning activities (Ruey, 2010), and they construct knowledge through social interaction with others (Huang, 2002).
Ruey investigated previous research studies which support a variety of constructivist instructional strategies for all kinds of learners and summarized the results into the following findings:

- Motivation and socialization of the learner positively impacts learning outcomes.
- Exchange of information included in course content is essential.
- Knowledge construction is the result of interactions and experiences.
- Development of personal goals encourages learning.
- Collaborative learning engages the learner.
- Student-centered, self-directed learning stresses critical thinking skills and self-reflection. (Ruey, 2010, p. 709)

Simonson et al. (2009) report that older students in distance education are more highly motivated, which is a significant element of overall student success—much more than the fact that the learner is in an online class. “Content, environment, finances, readiness, time, employment, and family” (Simonson et al., 2009, p. 70) are factors that affect learning at a distance, and anxiety may play a significant role in online attrition. The “learning to learn” of adult learning theory, according to Simonson et al. (2009, p. 70), is essential to lifelong learning and the essence of learning something for the sake of learning alone. Knowles advocates that adults are self-directed and autonomous learners, and that teachers are the facilitators rather than presenters of learning (as cited in Henschke, 2011).

Knowles’ adult pedagogy, known as Androgogy, consists of the following principles:
• The learner’s need to know—how learning is conducted, what learning will happen, and why learning is important.

• Self-directed learning—taking control of learning techniques and the purpose of learning.

• Prior experience of the learner—impacting learning by creating individual differences that provide robust learning resources and develop the adult’s self-identity.

• Readiness to learn—occurring when life’s situations create the need to learn.

• Orientation to learning—problem solving and acquiring knowledge that is presented in real-life context.

• Motivation to learn—the ability to solve important problems that occur in the lives of the adult learners. (as cited in Huang, 2002, p. 29)

Although varied opinions of adult learning theories exist, theorists (Henschke, 2011; Huijser, 2008; Ying et al., 2008) agree that the adult learner has specific needs that require improving instruction.

Attributes of Teachers of Adults

Social constructivist learning theory includes components of behavioral and cognitive theories that are situated in social settings. Instructors who replicate new roles and behaviors for learners within a social context of learning include these facets in online courses: (a) activities that develop a personal association with students, (b) peer review and feedback, and (c) interactions between students and with the instructor (Johnson & Aragon, 2002).
Huang (2002) proposes that instructors of adults provide positive reinforcement and present materials that are structured to meet the needs of adult learners in order to increase their chances of success. Additionally, instructors who ensure that communication channels with the learners are always open prevent social isolation (Huang, 2002).

Online instructors are urged to help learners identify and set challenging and attainable goals and to provide honest, timely, and explicit performance feedback (Artino, 2008). Effective instructors facilitate and guide the online learning experience, providing positive, safe, and motivating environments where learners can express themselves freely in appropriate ways (Huang, 2002). Adult learners desire to learn skills and information that relate to their real life or work experiences and that are meaningful, according to Huang (2002).

A persistent problem with online instruction is the high attrition rate for online classes. Research fails to reveal any significant direct relationship between completion of online courses and technology skills, but the student’s self-efficacy for online learning is enhanced by increased technology skills (Calvin & Freeburg, 2010). Instructors and online course designers would do well to examine the students’ paths from orientation to instruction to course completion in an attempt to retain students (Calvin & Freeburg, 2010).

Adult learners choose technical programs such as healthcare data technology in order to improve their lifestyles and develop a specialized skill set that allows them to become gainfully employed or increase their earning potential. Many adult learners change career paths or choose a program of study that can be completed in a short
amount of time. Thus, online courses appeal to the adult learner because of their personal schedules of work and family responsibilities. Online courses often provide the most viable options, but retention of content must be assured.

Learning Outcomes and Knowledge Retention

Rohrer and Taylor (2006) asserted that the capacity to learn is perhaps the most important mental ability, but the benefits of learning are lost if students forget the learned material, which can happen within days or weeks. Retention intervals, often neglected in research, can help explain how knowledge can be retained through variations in practice. When mastery of a skill or verbatim recall occurs through overlearning, continued practice is necessary to retain the knowledge and the application to associated tasks so that significant loss of knowledge retention can be avoided by introducing considerable practice on material already learned, and mastery can thus occur with minimum effort (Rohrer & Taylor, 2006).

Collard et al. (2009) believe that transference of factual knowledge into reasoning skills leads to increased reasoning abilities, while retention of the basic facts generally tends to decrease. The explanation of this phenomenon may rest with the concept that reasoning skills depend on acquisition and application of factual knowledge and are enmeshed within the newly acquired learning capacity. Collard et al. (2009) further argue that core knowledge and reasoning ability are positively linked.

Reasoning is primarily a problem-solving process. When course content is presented in the context of applied skills and knowledge leading to increased reasoning, learners develop a process of acquiring the new knowledge, organizing the information to be learned, and retrieving the knowledge (Collard et al., 2009). Rohrer and Taylor (2006)
suggest that assignments be structured to allow practice with three or four problems that relate to a new concept and that additional problems are inefficient use of study time. They also contend that varieties of problems may eliminate monotony and provide challenges to the learner regardless of age.

Varied learning strategies in the classroom provide positive results for retaining factual knowledge and subsequent application of skills to workplace situations. Collaboration, a constructivist teaching method, allows individuals to work together in the classroom to prepare them to interact with people when employed. Bloom (2009) utilizes collaborative testing, which shows improvement of students’ retention of course content. A student’s creativity, flexibility, and ability to work with others begin in the classroom through collaborative learning opportunities (Bloom, 2009).

Through collaborative learning, students exchange ideas, engage in critical thinking, debate possible answers, and develop problem-solving strategies (Bloom, 2009). Khourey-Bowers (2011) is a proponent of conceptual change in learning, suggesting that students bring misconceptions and naïveté into the classroom based on their limited understandings of their experiences and the world. Students’ conceptions are inconsistent with scientific views. In an effort to correct this disparity, Khourey-Bowers (2009) proposes conceptual change instruction to help students gain and reconfigure knowledge in order to enhance their abstract reasoning abilities. When unique skills are required, students are guided through course content using proven instructional strategies which are designed to ensure achievement and mastery.
Knowledge Retention of Medical Vocabulary

Because of the highly specialized language of healthcare careers, the possibility exists that medical vocabulary retention decreases without the associated application of problem-solving activities in sequential courses. When students connect the components of obtaining factual knowledge and translating medical procedures and services into coding categories, success is more likely to occur. Studies comparing performance in remembering factual knowledge and application tasks indicate that factual knowledge decreases as application of that knowledge increases (Collard et al., 2009). Experts and novices perform differently, not because of superior memorization abilities in experts, but because factual knowledge is triggered by stimuli that result in a well-organized response to the stimuli; as individuals gain experience through practice, their performance becomes automatic and efficient (Collard et al., 2009).

The importance of this study rests on how adults retain knowledge and apply that knowledge to real-world scenarios in healthcare administrative careers. Understanding adult learning pedagogy translates into successful retention of information, knowledge, and skills that are necessary for satisfactory job performance after formal training and education.

Understanding the Medical Language

The medical language is often complex with uniquely clinical meanings in the healthcare industry, and workers in this field are trained to understand and utilize the specialized vocabulary (Koch-Weser, Dejong, & Rudd, 2009). While personal experience with the medical language may negate most misunderstanding and misuse of medical terms, unexplained medical terms may adversely impact physician-patient and
employee-patient relationships and, ultimately, produce barriers to good healthcare outcomes (Koch-Weser et al., 2009). Technical terms exist in every physician-patient encounter, and medical healthcare workers are expected to abstract facts from medical records that are prepared by physicians when reporting patient care information to various agencies.

As individuals are trained for the healthcare industry, institutions and facilitators of learning introduce strategies that develop the necessary skills and factual knowledge that lead to workplace success. An important function of standard medical terminology is to reliably and consistently define medical concepts in every aspect of healthcare—both clinical and administrative (Watkins et al., 2009). When a patient receives professional medical services in a physician’s office, hospital, or ambulatory healthcare facility, documentation is provided. A comprehensive knowledge of medical vocabulary, anatomy, and physiology ensures that medical coders correctly abstract the information provided in the documentation, resulting in accurate reimbursement (AAPC, 2012).

Watkins et al. (2009) explain that information captured in a patient’s healthcare record is driven by regulations and standards, and incorrect or missing documentation concerning physician-patient encounters may result in decreased or loss of funding. Watkins et al. (2009) further clarify that patient data that are collected and tied to reimbursement have requirements related to administrative coding systems and that administrative healthcare personnel find it difficult, if not impossible, to manage reimbursement for facility services in the absence of reliable diagnostic and procedural coding processes. Basic terminology related to the human body systems is fundamental in the reimbursement of physician and facility services and procedures. Unfamiliarity
with medical terminology that relates to reimbursement terminology can result in miscommunication with medical insurance companies.

The dynamic environment of healthcare organizations requires internal and external communication plus the process of applying new and existing information as individuals are educated for healthcare careers. The healthcare data technology program presents opportunities to introduce trained and qualified individuals into patient healthcare administrative occupations.

Medical Billing and Coding

The framework of medical procedural coding supports a uniform language that “accurately describes medical, surgical, and diagnostic services” (Cohn, 2005, p. 50), which serves as a consistent nationwide system of communication among physicians and other healthcare workers.

Current trends in employment opportunities are indicative of a projected increase in the number of jobs in healthcare careers through 2016 primarily because of an aging population (Dillon, 2008). According to 2010 statistics, the baby-boomer generation that includes individuals born between 1946 and 1964 accounts for 26% of the total 2010 United States population and 18% of Americans age 65 and older, indicating an increase of 6% in the 65-years-and-older population (Cohn & Taylor, 2010). The healthcare field in general and medical billing and coding specifically are popular career choices as individuals seek education and training from private and public entities.

Medical coding, a nomenclature system used by medical insurers and healthcare providers to identify diagnoses and describe patient services, procedures, and products, is also used for statistical analysis, tracking the use of, and establishing reimbursement rates
for professional services provided for patients’ healthcare (Nutescu & Klotz, 2007). The American Medical Association (www.ama-assn.org) and Ingenix (www.ingenixonline.com) provide the print version of approved diagnostic codes known as *ICD-9-CM* or *International Classification of Diseases, Ninth Revision, Clinical Modification*; the diagnostic codes can also be accessed on the Center for Medicare and Medicaid’s Web site (www.cms.hhs.gov/medlearn/icd9code.asp). Approved procedural and service codes are found in a manual created by the American Medical Association called *CPT* or *Current Procedural Terminology* (AMA, 2012).

The *ICD-9-CM* and *CPT* are revised annually, and strict adherence to coding guidelines is required for successful reimbursement of services, procedures, and products provided to patients from physicians and facilities. By October 2013, implementation of *ICD-10-CM* or *International Classification of Diseases, Tenth Revision, Clinical Modification* will be federally mandated and will create thousands of additional codes for health-related conditions, incorporating extensive medical terminology.

Nutescu and Klotz (2007) allude to the importance of the patient’s medical record because procedural and diagnostic coding is based on the information found in the medical record and not on the basis of reimbursement levels. The significance of the patient’s medical record cannot be overemphasized, as this documentation is the source for coding and ultimately the billing for reimbursement, not to mention the physician’s legal record of the healthcare of the patient. Essentially, if the patient’s record does not include documentation of the procedures, services, and products rendered by the physician or facility, coding cannot take place. The coder’s ability to select appropriate
codes after reviewing documentation in patients’ medical records ensures proper and timely reimbursement.

*Mastering Medical Coding*

Medical terminology mastery is crucial to support manual and automated healthcare information data processing systems (Nyström, Merkel, Petersson, & Åhlfeldt, 2007). The billing and coding aspect of healthcare administration drives the financial side of the business, and with the scheduled *ICD-10-CM* implementation, increased and continued study in medical terminology is suggested. Medical billing and coding expertise is necessary for third-party reimbursement of healthcare costs related to inpatient and outpatient medical services and procedures.

Although CPT provides healthcare providers with a system of billing for services and procedures, the use of CPT does not guarantee payment by the insurance company. Denials are generally the result of the insurance company’s inability to recognize the provider as legitimate, believing that the service is experimental with inadequate research supporting the services, thinking that the reimbursement was *bundled* or included with other more distinct services, and believing that the service was duplicated (Cohn, 2005). Education in the use of the CPT and documentation ensures that claims are defensible and that evidence of medical necessity of services and medical interventions are justified (Cohn, 2005).

Medical billers and coders submit insurance claims for reimbursement, generate patient bills, document medical services using correct medical terminology, and adhere to insurance policies and procedures (Campbell, 2010). They are instrumental in supporting and facilitating the healthcare environment by understanding and selecting codes that
represent every aspect of patient care. Billers and coders are fundamental to a physician’s practice and ensure that the doctor is “accountable and paid for the services provided” by generating appropriate codes for physician services, (Campbell, 2010, p. 54).

Entry-level requirements for medical billers and coders require satisfactory completion of a training program at an accredited institution, which includes courses such as medical terminology, anatomy and physiology, medical documentation, and medical office concepts. Obtaining national certification credentials ensures that medical billers and coders have the fundamental knowledge and coding expertise required of healthcare administrative personnel.

Summary

Chapter II provided a relevant literature review of the basic hypotheses and question of this research study, which sought to determine (a) if medical terminology performance scores differ based on instructional format; (b) if knowledge retention levels of medical terminology differ based on instructional format; (c) if scores on students’ medical coding final exams differ as a function of medical terminology class type, covarying medical vocabulary knowledge retention; and (d) if other factors such as hours devoted to studying, childcare responsibilities, the number of work hours, and ethnicity separately or in combination made a difference in medical vocabulary knowledge retention and the learning outcomes of medical coding.

The theoretical basis for learning was explored through a literature review, and three major concepts were discussed: Behaviorism, Cognitivism, and Constructivism. The theorists who proposed and supported these learning theories—Dewey, Bandura, and
Vygotsky, respectively—were also introduced. One learning theory was deemed insufficient for content delivery, whereas an overlapping of theories yielded greater learning achievement. Adult learning theories and concepts related to understanding how adults learn were included, as well as factors that affect retention of factual knowledge and student learning outcomes. The community college system with its role in adult learning has a long-standing commitment to the community in which each college is located; therefore, information regarding the community college’s responsibility in preparing students for careers was reviewed.

The methodology of this study described in Chapter III includes supporting evidence for collecting and analyzing the data that provided the answers to the one research question and three research hypotheses. The explanation and description of the research design, participants, setting, and instrumentation provide a detailed account of the study.
CHAPTER III

METHODOLOGY

This chapter provides detailed information regarding the research setting of this study, participants involved in the study, research design incorporated, instrumentation, data collection, and analysis procedures. The purpose of this study was to assess if the type of instructional format—online or face-to-face delivery of course content—of a medical terminology course affected medical vocabulary knowledge retention and the learning outcomes in a subsequent medical procedural coding course. In addition, this study identified and examined other factors, derived from cross-sectional questionnaire responses obtained from the participants, to determine their influence separately or in combination on the outcome of medical vocabulary knowledge retention and medical procedural coding performance.

The following hypotheses and research question were the focus of the study:

- Research Hypothesis 1: Medical terminology performance scores differ based on instructional format.
- Research Hypothesis 2: Knowledge retention levels of medical terminology differ based on instructional format.
- Research Hypothesis 3: Scores on medical coding final exam differ as a function of medical terminology class format, covarying medical vocabulary knowledge retention.
- Research Question: Do other factors—age, ethnicity, gender, the number of hours devoted to studying, childcare or family responsibilities, and the number of work hours—separately or in combination make a difference in medical
vocabulary knowledge retention and the outcome of procedural medical coding?

Research Setting

A southeastern community college with a healthcare data technology program was selected as the setting of this research study. The location of the college and the sizeable annual enrollment in the healthcare data technology program at the community college were factors in its selection as the target of the study. Although the researcher teaches courses in the healthcare data technology program, complete anonymity of participants was guaranteed through the use of a research assistant who had no direct contact with participants in the healthcare data technology courses and through the creation of student-generated codes to mask personal identities.

The majority of students enrolled in the healthcare data technology program are adult learners with 30% of study participants for this research study falling in the over-40 age category. Many return to community college programs to improve their financial statuses because of changes in family dynamics or out of necessity to provide for children. The economic downturn of recent years also compels many who are not employed to seek training for available jobs. While many returning students have been out of high school for a number of years, they quickly adjust to the demands of study and are generally organized and self-sufficient. Personalities tend to blend among the age groups and across ethnicity.

Federal, state, and/or local guidelines mandate that program instructors at the college track the students after program completion regarding job placement in the field trained, national certification attainment, and employer satisfaction related to the
completers’ skills, productivity, and performance. The research study addressed medical coding proficiency based on face-to-face and online instructional formats of the prerequisite medical terminology course.

**Research Participants**

This research study incorporated a purposive sampling of two distinct intact groups of individuals who were identified at the selected community college and who were asked to participate. The two groups were enrolled in the coding courses in 2010-2011 and 2011-2012. The focus of the study specifically addressed medical coding proficiency and necessitated the selection of participants based on three criteria: (a) enrolled in a healthcare data technology program, (b) completed the prerequisite medical terminology in online or face-to-face instructional formats, and (c) enrolled in the medical procedural coding course. The convenience of the college location and the large number of individuals enrolled in the program provided a satisfactory research sample with sufficient data necessary to test the hypotheses of the study.

The research sample consisted of 94 participants who were enrolled as students in the healthcare data technology program at the targeted southeastern community college between 2010 and 2012. The initial prerequisite course for subsequent medically-related courses was a medical terminology course. Successful completion (that is, final grade average of 70 or above) of the medical terminology course was required for enrollment in the medical procedural coding course. Students who did not meet this requirement were not eligible to participate in the study because they could not enroll in the medical coding course.
General admission requirements of the community college sufficed for admission requirements of learners who wished to major in the healthcare data technology program. During the 2010-2011 and the 2011-2012 academic years, approximately 205 students declared their major in the healthcare data technology program. Out of 205 students, 97 were eligible for inclusion in the study because of their enrollment in procedural medical coding after successfully completing the prerequisite medical terminology course. Three students declined the invitation to participate in the research study. The research sample yielded two groups of students over two years: Group 1, comprised of 53 participants from the first year, completed the procedural medical coding class in December 2011, and Group 2, comprised of 41 participants from the second year, completed the procedural medical coding class in December 2012. Students from both groups had previously completed the medical terminology course via an online instructional format or the traditional face-to-face instructional format.

Participants in the study represented a diversity of ethnic and cultural backgrounds, ages, and genders. Typical ethnicities in the healthcare data technology program at the community college selected for the study included African American, Asian, and Caucasian, and the age range of the participants was 21 to 56 years, thus requiring no parental permission for participation in the research study. Exclusions from the study were not apparent because all of the students eligible to participate were majors in the healthcare data technology program at the community college, had completed the required medical terminology course, and were enrolled in medical procedural coding.

To guarantee anonymity of participants and confidentiality of data used in the formal reporting of the research findings, the researcher enlisted the aid of a research
assistant during the data collection and collation process. The research assistant removed identifying information from the data when collected and prior to transferring the information to the researcher for analysis and reporting of findings. In soliciting the aid of the participants in the research study, the research assistant provided a consent form for each participant (see Appendix A), offered information regarding the research procedures, explained that participation was voluntary and that withdrawal at any time from the research study was allowed, and discussed with the participants that the findings of the study neither would nor could be directly connected to the participants.

**Research Design**

This study employed a quantitative research design to address how students learn and how the transfer and assessment of student learning outcomes occurred. A quantitative research design explores the relationship among selected variables and addresses the research question and hypotheses that were specific, measurable, and observable. In an effort to explain if instructional format and/or medical terminology knowledge retention affects coding proficiency, the quantitative approach provides the statistical answers to comparisons of data in this study. In addition, the responses to the demographic and opinion questionnaire were addressed statistically.

In collecting data for the research study, three sets of test scores and responses to a demographic and opinion questionnaire were obtained between Fall 2010 and Fall 2012. Three research hypotheses utilized the test score data while the research question utilized responses to the questionnaire. Testing in both online and face-to-face medical terminology course sections and face-to-face medical procedural coding course sections
was routinely accomplished in the Desire2Learn course management system and ensured that all students were familiar with and comfortable in equitable testing environments.

The first test scores, referred to in this study as FE1, were obtained from the medical terminology course final exam. These scores were stored in the Desire2Learn course management system from the semester in which the participants completed the medical terminology course. The second test scores, referred to as FE2, were obtained by administering a repeated medical terminology final exam during the first week of class in the subsequent medical procedural coding course during the fall semester of the healthcare data technology program, approximately the third week of August. The purpose of the repeated exam was to determine the amount of medical vocabulary knowledge retention from the medical terminology course. Prior to taking the repeated medical terminology final exam in the coding class, participants completed the demographic and opinion questionnaire used in response to the research question. The third test scores, referred to as Coding, were the final exam grades from the medical procedural coding course in the fall semesters, completed the first week of December.

Two groups of participants yielded the data over two years, providing a larger sample size to conduct this quantitative study. Group 1 participants were enrolled in the coding course in the Fall 2011 semester and had completed their initial medical terminology course previously. Group 2 participants were enrolled in the coding course in the Fall 2012 semester and had completed their initial medical terminology course previously. The data that was collected and analyzed provided the answers to the research question and hypotheses in the study. For each research hypothesis and question, SPSS statistical software was utilized for all analyses as follows.
Research Hypothesis 1 - Medical terminology performance scores differ based on instructional format.

A one-way Analysis of Variance (ANOVA) statistical analysis compared the means of the medical terminology final exam scores (FE1) to determine if instructional class format (ClassFormat) affected medical terminology final exam scores, thus providing the results for the first research hypothesis. A one-way ANOVA statistical analysis is used when statistical comparisons are made using one independent variable (ClassFormat) and one dependent variable (FE1). The independent variable, ClassFormat, was treated as a true independent variable for analyses for the research hypotheses.

Research Hypothesis 2 - Knowledge retention levels of medical terminology differ based on instructional format.

To provide the results for the second research hypothesis, a statistical comparison and transform of the means of the medical terminology final exam scores (FE1) with the repeated medical terminology final exam scores (FE2) produced a knowledge retention variable employing the following calculation: FE2 – FE1 = Retention. Again, a one-way ANOVA was utilized to investigate the effect of instructional class format (ClassFormat) on medical vocabulary knowledge retention (Retention).

Research Hypothesis 3 - Scores on medical coding final exam differ as a function of medical terminology class format, covarying medical vocabulary knowledge retention.

To investigate the third research hypothesis, an Analysis of Covariance (ANCOVA), incorporating a general linear model, determined if instructional class format (ClassFormat) after factoring for the knowledge retention covariate (Retention)
affected the means of the medical coding final exam scores (Coding). An ANCOVA statistical analysis is utilized when one independent variable (ClassFormat), one dependent variable (Coding), and a covariate (Retention) are examined.

Research Question - Do other factors—age, ethnicity, gender, the number of hours devoted to study, childcare or family responsibilities, and the number of work hours—separately or in combination make a difference in medical vocabulary knowledge retention and the outcome of procedural medical coding?

Descriptive frequencies and means translated participant demographic and opinion responses to statistical measurements for analysis. From questionnaire responses provided by the participants, other factors—age, ethnicity, gender, work hours, study hours, and family responsibilities—were examined to determine if each factor separately or in combination were related to medical procedural coding outcomes. Participant responses to ten Likert statements that were rated from one (strongly disagree) to six (strongly agree) provided the opinions of participants regarding levels of satisfaction concerning their selection of instructional format for medical terminology. The demographic and opinion questionnaire is included in Appendix B.

Instrumentation

Three tests and a questionnaire provided the scores and responses to analyze the research question and hypotheses for this research study. The three test score sources were the initial medical terminology final exam (FE1), the repeated medical terminology final exam (FE2), and the medical coding final exam (Coding). The questionnaire was administered in the same coding class prior to the repeated medical terminology final exam. Descriptions of each instrument are presented in detail below.
Medical Terminology Final Exam and Repeated Medical Terminology Final Exam

A comprehensive, objective, and proctored final examination instrument was administered in the medical terminology course sections—online and face-to-face—and was repeated in the medical procedural coding course sections the following semester. Consisting of 150 questions, the examination included multiple choice, true/false, and matching questions related to human anatomy, physiology, pathology, diagnostic, and therapeutic medical terminology. Principally based on Latin and Greek languages, medical word elements—prefixes, roots, and suffixes—were presented throughout the medical terminology course as the knowledge base for the final examination. The test questions were generated by the instructor, patterned from test banks of suggested questions developed by the textbook publishers, and included varying degrees of difficulty. The medical terminology final exam was repeated in the medical procedural coding course in the same format as the original final exam. The time limit for both test administrations was two hours. Test questions were scored according to accepted standards of medical vocabulary, anatomy, and physiology.

All medical terminology testing throughout the semester including the final exam was conducted using the Desire2Learn learning management system, thus providing comparable testing environments for both online and face-to-face students. The final exam in the medical terminology online course sections was completed at the college campus testing center under the supervision of a test proctor. The final exam in the medical terminology face-to-face course sections was completed in the classroom under the supervision of the instructor.
Medical Coding Final Exam

The final group of scores was obtained from the final exam in the medical procedural coding course sections. All coding sections were exclusively offered in a face-to-face instructional format. The two-part final exam consisted of theory and practical applications. Questions included on the theory test were developed by the instructor based on procedural coding guidelines established by the American Medical Association and included in the Current Procedural Terminology (CPT) coding manual. The theory portion was completed in Desire2Learn and consisted of 75 objective questions, including multiple choice and true/false questions relating to the guidelines and rules pertaining to procedural code selection and assignment. The time limit for the theory portion was 1.5 hours. Scoring of each test item was based on accepted coding guidelines and rules governing code selection.

The practical application portion of the final exam consisted of 33 medical cases that required the selection and assignment of appropriate CPT code(s) related to services, procedures, and encounters with healthcare personnel and facilities. The cases were representative of medical cases that were encountered in the coding course materials and encompassed all human organ systems. During the two-hour maximum testing period for the practical application portion, participants read the medical reports, interpreted the medical documentation, and located and assigned the correct code in order to simulate claim submission to obtain reimbursement from third-party insurance payers. These five-digit CPT codes were also appended as necessary with two-digit numeric, alphanumeric, or alpha modifiers for maximum specificity resulting in proper reimbursement.

Evaluation of participants’ responses to the theory and the cases provided on the

Demographic and Opinion Questionnaire

The demographic and opinion questionnaire included two sections—demographic factors and opinion statements (see Appendix B). The seven-question demographic portion of the questionnaire included specific statements regarding gender, age, ethnicity, class format for medical terminology, number of hours worked during medical terminology course, whether childcare responsibilities were involved, and number of hours a week spent studying medical terminology. Respondents checked the appropriate closed responses related to each question. The opinion portion of the questionnaire included ten Likert statements regarding the satisfaction of the respondents concerning their choice of class format for medical terminology. Respondents were asked to rate their opinions concerning each statement from one (strongly disagree) to six (strongly agree).

The following ten opinion statements comprised the second section of the questionnaire:

1. Learning medical terminology was difficult because of the format I selected.
2. The format I chose had no impact on the degree to which I learned medical terminology.
3. The content and materials provided in this format adequately met my needs as a learner.
4. I would learn medical terminology more easily in a traditional face-to-face setting.

5. I would retain medical terms and their definitions better if I spent more time studying.

6. Compared to other courses in the program, this course was very challenging.

7. I prefer traditional classes rather than online classes.

8. There is no difference in instruction between online and traditional classes.

9. I made a good decision about the format chosen for medical terminology and would make the same decision again.

10. I would recommend that students take medical terminology in the format I selected.

Data Collection Procedure

The idea of this research study was conceptualized based on the need to ensure medical coding proficiency for healthcare data technology students. Realizing that many students do not complete the program and that even completers of the program do not always obtain employment led this researcher to investigate the need for the study through existing research or lack thereof. Identifying factors that affect coding proficiency that relates to acquiring the necessary coding skills was the principle reason for the process of choosing participants. The first course of the medically related courses in the HDT program to be completed by HDT students is medical terminology. One of the last courses is medical procedural coding. Therefore, students enrolled in the HDT program, who had completed medical terminology, and were enrolled in procedural coding were the obvious candidates to solicit for this study.
The concept was then approved by the Institutional Review Board from the author’s university and the community college to collect and use data from individuals who volunteered to participate in the study (see Appendixes C, D, E, F, and G). The initial approval was for an independent study to collect preliminary data from 2010 to 2011. The IRB also granted a continuation of that study to collect data through 2012. Following the successful defense of the dissertation proposal, the researcher submitted a formal request to the IRB to use the preliminary data for this study and to collect the final data in December 2012. Permission was granted.

A consent form was developed for distribution to potential participants (see Appendix A). The consent form included pertinent information regarding the study, what data would be collected and examined, that participation was completely voluntary, and that withdrawal from the study was possible at any time. The consent form also explicitly described the process of assuring anonymity through the use of student-generated codes.

Some of the participants would possibly be enrolled in this researcher’s classes; therefore, a research assistant was enlisted to aid in collecting data, presenting the study to the students, and finally in collating and transferring the data to the researcher after identifying elements were removed. To ensure anonymity, each of the participants created a code consisting of the last two digits of the participant’s Social Security number and the last four digits of the participant’s college identification number. All data collected for the study was labeled with the participant-generated code to ensure that any identifying information was removed prior to data analyses. The researcher, with the aid
of a research assistant, collected data from 94 participants who agreed to participate in the study.

Data collection occurred for the first year participants (Group 1) between Fall 2010 and Fall 2011 and for the second year participants (Group 2) between Fall 2011 and Fall 2012 and is presented graphically in Appendix H. Data for the study were collected from four sources as described below.

First, test scores from the medical terminology final exam that was administered in the medical terminology classes (online and face-to-face formats), were collected and transferred to a spreadsheet by the research assistant, removing identifying elements and attaching the student-generated codes. These scores were accessed through the Desire2Learn course management system where they were digitally stored. When study participants agreed to be part of this research study, they gave permission for these scores to be accessed and analyzed. Scores from students in the medical terminology classes over two years were retrieved and used. This part of data collection required no time commitment from the students in the study.

The second and third data collection occurred during the first week of the fall semesters during both years. The medical terminology final exam was repeated in the medical procedural coding class to determine the degree of retention that occurred between the medical terminology course completion and the beginning of the coding course. Students in the medical procedural coding classes routinely complete a repeated medical terminology final exam which requires a maximum of two hours. The repeated medical terminology exam was administered through the Desire2Learn course management system. The repeated test is part of the course requirement for the coding
class to assess medical vocabulary retention and required no additional time on the part of the participants. Prior to beginning the repeated final exam in the coding classes, study participants were asked to complete the questionnaire which required approximately 10 minutes. The research assistant collected the questionnaire. Following completion of the repeated exam, the assistant also retrieved and collated the scores in a spreadsheet for transfer to the researcher.

The fourth and final data collection occurred during the last week of classes in the medical procedural coding classes in the fall semesters of both years. Test scores from the medical coding final exam administered in the medical procedural coding classes were the source of this data. The two-part exam included theory and application of coding to patient’s medical cases. Because the final exam is required for all coding students in the coding classes, no additional time commitment for participants was involved. Once again, scores from the theory portion were retrieved from the course management system by the research assistant. The scores from the application portion of the exam were given to the research assistant for collation with the theory portion and were then transferred to the researcher after identifying elements were removed.

The research assistant collected, organized, and transferred to the researcher all scores for medical terminology final exam scores (FE1) and repeated medical terminology final exam scores (FE2), the procedural coding final exam scores (Coding), and the responses from the demographic and opinion questionnaires according to the student-generated code, removing any identifying names. Data collection from all study participants concluded in December 2012.
The Desire2Learn learning management system utilized by the community college system incorporates online testing for all online, hybrid, and Web-enhanced courses. Students in face-to-face and online medical terminology courses complete online assessments and testing within the Desire2Learn course management system. The medical terminology course online and face-to-face sections were designed with identical content structure and requirements; therefore, equivalent testing conditions existed in both face-to-face and online instructional formats.

The Desire2Learn course management system digitally stored all scores from the Medical Terminology final exam (FE1), repeated final exam (FE2), and medical procedural coding final exam (Coding), allowing straightforward and seamless collection of data for analysis.

Data Analysis

The researcher selected SPSS statistical software to analyze the collected test scores data using ANOVA and ANCOVA and to provide frequencies and descriptive statistics of the demographic and opinion questionnaire responses. The first research hypothesis was addressed using a one-way ANOVA to determine if instructional class format (ClassFormat) affects the means of medical terminology final exam scores (FE1).

For the second research hypothesis, a medical vocabulary knowledge retention variable was created by comparing the means of the medical terminology final exam scores (FE1) and the repeated medical terminology final exam scores (FE2) to create a medical vocabulary knowledge retention variable (FE2 – FE1 = Retention). A one-way ANOVA then provided the analysis to determine if instructional format (ClassFormat) affects medical vocabulary knowledge retention (Retention).
For the third research hypothesis, an ANCOVA provided statistical analysis of the effect of instructional class format (ClassFormat), factoring for medical vocabulary knowledge retention (Retention), on the means of the medical procedural coding final exam scores (Coding).

Frequencies and descriptive analyses of the demographic and Likert statements provided an opportunity to examine the participants’ opinion ratings regarding their selection of medical terminology instructional format. The demographic responses provided information to determine their influence on knowledge retention of medical terminology and medical coding learning outcomes. Analyses of factors identified through the questionnaire were evaluated to determine if elements other than medical vocabulary knowledge retention and instructional format predicted procedural medical coding achievement.

For this research study, several variables were analyzed: (a) means from the medical terminology final exam scores (FE1) from all sections of the face-to-face and online course formats, (b) means from the repeated final exam scores administered in the medical procedural coding courses (FE2), (c) responses to the demographic and opinion questionnaire, (d) the knowledge retention covariate (Retention), and (e) means of the procedural coding final exam scores (Coding). For Research Hypothesis 1, the dependent variable was FE1, and the independent variable was ClassFormat. For Research Hypothesis 2, FE1 and FE2 were compared to create a covariate (FE2 - FE1 = Retention). For Research Hypothesis 3, the independent variable was ClassFormat, the dependent variable was Coding, and the covariate was Retention.
Summary

Chapter III included methods for conducting this research study by describing the selection of participants and participant descriptions, the research design and reasons for selecting the design, study instrumentation, data collection procedure, and data analysis. Chapter IV presents the detailed results of the research study in narrative and graphical arrangement. The results of the statistical analyses used to address the research question and the research hypotheses are provided.
CHAPTER IV

RESULTS

The purpose of this study was to determine if the type of instructional format—online or face-to-face—of a medical terminology course affected medical vocabulary performance scores, medical vocabulary knowledge retention, and the learning outcomes in a subsequent procedural medical coding course. This study also identified and examined other factors to determine their potential influence separately or in combination on the outcome of medical vocabulary knowledge retention and medical procedural coding performance. This chapter includes the findings of the data analyses to address the research question and three research hypotheses.

In addition to the formal research hypotheses addressed in this study, data gathered from Likert statements on a questionnaire (see Appendix B) in response to the research question enabled comparisons of traditional and online classroom students’ satisfaction levels regarding their selection of the type of medical terminology instructional format and any impact on learning medical vocabulary. Additionally, other demographic factors were examined to determine their influence, if any, on knowledge retention. The three research hypotheses were addressed by examining participants’ scores that were collected from three testing occasions.

Research Question

The Research Question for this study is, “Do other factors—age, ethnicity, gender, the number of hours devoted to study, childcare or family responsibilities, and the number of work hours—separately or in combination make a difference in medical vocabulary knowledge retention and the outcome of procedural medical coding?”
Frequencies and means in SPSS statistical software were used to explain the factors that were identified in a questionnaire completed by the study participants. The findings are presented in Table 1 as shown below.

Table 1

*Frequencies of Participants’ Demographics*

<table>
<thead>
<tr>
<th>Demographics</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 = Female</td>
<td>89</td>
<td>94.7</td>
</tr>
<tr>
<td>2 = Male</td>
<td>5</td>
<td>5.3</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 = 21-25</td>
<td>19</td>
<td>20.2</td>
</tr>
<tr>
<td>2 = 26-30</td>
<td>19</td>
<td>20.2</td>
</tr>
<tr>
<td>3 = 31-35</td>
<td>17</td>
<td>18.1</td>
</tr>
<tr>
<td>4 = 36-40</td>
<td>11</td>
<td>11.7</td>
</tr>
<tr>
<td>5 = 41-older</td>
<td>28</td>
<td>29.8</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 = Asian</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td>2 = American Indian</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3 = Hispanic/Latin-American</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>4 = Vietnamese</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5 = Black/African-American</td>
<td>22</td>
<td>23.4</td>
</tr>
<tr>
<td>6 = White/Caucasian</td>
<td>67</td>
<td>71.3</td>
</tr>
<tr>
<td>Medical Terminology Class Format</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 = Face-to-Face</td>
<td>64</td>
<td>68.1</td>
</tr>
<tr>
<td>2 = Online</td>
<td>30</td>
<td>31.9</td>
</tr>
<tr>
<td>Hours Worked Per Week</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 = none</td>
<td>44</td>
<td>46.8</td>
</tr>
<tr>
<td>2 = 1-5</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td>3 = 6-10</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td>4 = 11-15</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td>5 = 16-20</td>
<td>5</td>
<td>5.3</td>
</tr>
<tr>
<td>6 = 21-30</td>
<td>8</td>
<td>8.5</td>
</tr>
<tr>
<td>7 = 31-40</td>
<td>28</td>
<td>29.8</td>
</tr>
<tr>
<td>Childcare Responsibilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 = yes</td>
<td>52</td>
<td>55.3</td>
</tr>
<tr>
<td>2 = no</td>
<td>42</td>
<td>44.7</td>
</tr>
</tbody>
</table>
Table 1 (continued).

<table>
<thead>
<tr>
<th>Demographics</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours Studied Medical Terminology Per Week</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 = none</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>2 = 1-2</td>
<td>9</td>
<td>9.6</td>
</tr>
<tr>
<td>3 = 3-4</td>
<td>28</td>
<td>29.8</td>
</tr>
<tr>
<td>4 = 5-6</td>
<td>32</td>
<td>34.0</td>
</tr>
<tr>
<td>5 = more than 6</td>
<td>25</td>
<td>26.6</td>
</tr>
</tbody>
</table>

Frequencies of the data reveal that more than 90% of the participants were female. About 30% were 41 years of age or older, and almost three-fourths were of white/Caucasian ethnicity. Of the 94 participants, 68% chose the traditional face-to-face class format. More than half of the study’s participants indicated some childcare responsibility with fewer than 30% being employed 31 to 40 hours per week while taking the medical terminology course. Almost half of the participants were not employed during the semester. Ninety percent studied between three and six hours per week.

Ten Likert statements were included in a questionnaire completed by the research study participants to assess each participant’s satisfaction with his/her selection of instructional format for the medical terminology course. Participants responded to each statement using a six-point rating system for each statement—from 1 (strongly disagree) to 6 (strongly agree). Descriptive statistics provided the means indicating those statements to which the respondents provided ratings toward the strongly agree range as shown below in Table 2. The statements are being addressed with only a descriptive approach.
Table 2

Participants’ Satisfaction Regarding Selection of Instructional Format of Medical Terminology Course

<table>
<thead>
<tr>
<th>Statements</th>
<th>Face-to-Face $M$</th>
<th>Online $M$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Learning Difficult Regarding Format</td>
<td>1.67</td>
<td>2.00</td>
</tr>
<tr>
<td>2. Format Made No Impact</td>
<td>2.81</td>
<td>4.30</td>
</tr>
<tr>
<td>3. Adequate Content &amp; Materials</td>
<td>5.13</td>
<td>5.27</td>
</tr>
<tr>
<td>4. Learn More Easily in Traditional</td>
<td>5.17</td>
<td>3.23</td>
</tr>
<tr>
<td>5. Studying Helps Retention</td>
<td>4.79</td>
<td>4.47</td>
</tr>
<tr>
<td>6. Challenging Course</td>
<td>3.35</td>
<td>3.43</td>
</tr>
<tr>
<td>7. Prefer Traditional Class</td>
<td>4.97</td>
<td>3.40</td>
</tr>
<tr>
<td>8. No Difference in Format</td>
<td>1.78</td>
<td>2.76</td>
</tr>
<tr>
<td>9. Good Decision Regarding Format</td>
<td>5.13</td>
<td>4.63</td>
</tr>
<tr>
<td>10. Would Recommend Format Selected</td>
<td>5.37</td>
<td>3.97</td>
</tr>
</tbody>
</table>

Analyses of frequencies and means provided participants’ satisfaction levels regarding selection of instructional format of the medical terminology course. Complete summaries of the findings are available in Appendixes I and J.

Statements #1 and #8 were not reversed for statistical analyses. For Statement #1, “Learning medical terminology was difficult because of the format I selected,” more than half of the participants indicated that they did not think the instructional format they selected was associated with greater difficulty of the medical terminology course. Responses to Statement #2, “The format I chose had no impact on the degree to which I learned medical terminology,” suggested no apparent agreement regarding whether instructional format made a difference on individual learning outcomes.
For Statements #3, “The content and materials provided in this format adequately met my needs as a learner,” more than half of the participants were satisfied with the quality of content and materials in both online and face-to-face classes. Responses to Statement #4, “I would learn medical terminology more easily in a traditional face-to-face setting,” and Statement #7, “I prefer traditional classes rather than online classes,” signify that the majority prefers the face-to-face instructional format.

When responding to Statement #9, “I made a good decision about the format chosen for medical terminology and would make the same decision again,” and Statement #10, “I would recommend that students take medical terminology in the format I selected,” more than half of the participants would again make the same choice of instructional format and would recommend that others select their chosen format.

Statement #8, “There is no difference in instruction between online and traditional classes,” elicited negative responses from more than half of the research participants.

Participant responses to Statements #4, #7, #5, #9, and #10 were further examined by splitting the data file into groups. The age of the participant and type of instructional format were examined (see Table 3 below). The means for Statement #4, “I would learn medical terminology more easily in a traditional face-to-face setting,” ranged from 5.00 to 5.33 for those participants who completed the course in a traditional setting. This was an indication that the research respondents in all age categories concurred that learning was more easily accomplished in a traditional classroom setting than online. The means for Statement #4 of online participants ranged from 3.00 to 4.00, lower than participants who completed the course in the face-to-face classroom, yet gravitating toward the agree to strongly agree ratings. Age did not seem to be a significant factor in the ratings.
### Table 3

**Questionnaire Statements Based on Age and Class Format**

<table>
<thead>
<tr>
<th>Age</th>
<th>Class Format</th>
<th>#4 Learn Better In F2F Class</th>
<th>#7 Prefer F2F To Online</th>
<th>#5 Studying Helps With Retention</th>
<th>#9 Format Selected Was Good Decision</th>
<th>#10 Recommend Format To Others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M</td>
<td>SD</td>
<td>n</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>21-25</td>
<td>F2F</td>
<td>15</td>
<td>5.27</td>
<td>1.49</td>
<td>5.33</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td>Online</td>
<td>4</td>
<td>4.00</td>
<td>2.16</td>
<td>3.50</td>
<td>1.73</td>
</tr>
<tr>
<td>26-30</td>
<td>F2F</td>
<td>11</td>
<td>5.09</td>
<td>1.30</td>
<td>4.45</td>
<td>1.81</td>
</tr>
<tr>
<td></td>
<td>Online</td>
<td>8</td>
<td>3.13</td>
<td>2.03</td>
<td>3.38</td>
<td>1.60</td>
</tr>
<tr>
<td>31-35</td>
<td>F2F</td>
<td>13</td>
<td>5.00</td>
<td>1.23</td>
<td>4.46</td>
<td>1.71</td>
</tr>
<tr>
<td></td>
<td>Online</td>
<td>4</td>
<td>3.50</td>
<td>.58</td>
<td>4.50</td>
<td>1.73</td>
</tr>
<tr>
<td>36-40</td>
<td>F2F</td>
<td>6</td>
<td>5.33</td>
<td>1.22</td>
<td>5.67</td>
<td>.52</td>
</tr>
<tr>
<td></td>
<td>Online</td>
<td>5</td>
<td>3.00</td>
<td>2.00</td>
<td>2.80</td>
<td>1.92</td>
</tr>
<tr>
<td>41+</td>
<td>F2F</td>
<td>18</td>
<td>5.22</td>
<td>1.48</td>
<td>5.11</td>
<td>1.41</td>
</tr>
<tr>
<td></td>
<td>Online</td>
<td>9</td>
<td>3.00</td>
<td>1.73</td>
<td>3.22</td>
<td>1.39</td>
</tr>
</tbody>
</table>

*Note.* Participant ratings were based on a Likert scale from 1 (strongly disagree) to 6 (strongly agree).

The means for Statement #7, “I prefer traditional classes rather than online classes,” ranged from 4.45 to 5.67 for the study participants who completed the course in the face-to-face classroom while online participant means ranged from 2.80 to 4.50. The majority of the sample means indicated strong preference for traditional instruction, even though a third of the participants chose the online option. Again, age was not an apparent factor in the ratings for Statement #7.

Age did not appear to impact the ratings for Statement #5, “I would retain medical terms and their definitions better if I spent more time studying.” All of the study participants, regardless of their selection of the traditional or face-to-face instructional format, indicated that studying would help in retention of the medical terms. Every age category also expressed satisfaction with their decision regarding instructional format.
selection. Responses to Statement #9, “I made a good decision about the format chosen for Medical Terminology and would make the same decision again,” signified high levels of satisfaction regarding participants’ choice of instructional format.

The means of satisfaction ratings for Statement #10, “I would recommend that students take Medical Terminology in the format I selected,” were high, ranging from 4.73 to 5.83 for traditional format, and 3.60 to 4.25 for online format. Although the majority of participants in both online and face-to-face instructional formats agreed that they would recommend their chosen instructional format to others, those in the traditional classroom indicated higher ratings regarding their willingness to recommend the format.

Further analysis was conducted by splitting the data into groups delineated by the number of hours studied each week and the potential effect on the means of the medical terminology final exam and repeated final exam scores as shown below in Table 4.

Table 4

*Means of Medical Terminology Scores Based on Study Hours and Class Format*

<table>
<thead>
<tr>
<th>Study Hours</th>
<th>Class Format</th>
<th>FE1</th>
<th>FE2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><em>M</em></td>
<td><em>SD</em></td>
</tr>
<tr>
<td>1-2 F2F</td>
<td>77.11</td>
<td>13.52</td>
<td>68.00</td>
</tr>
<tr>
<td></td>
<td>64.50</td>
<td>2.12</td>
<td>65.00</td>
</tr>
<tr>
<td>3-4 F2F</td>
<td>78.12</td>
<td>11.93</td>
<td>66.00</td>
</tr>
<tr>
<td></td>
<td>77.92</td>
<td>12.87</td>
<td>67.37</td>
</tr>
<tr>
<td>5-6 F2F</td>
<td>78.26</td>
<td>10.16</td>
<td>69.05</td>
</tr>
<tr>
<td></td>
<td>64.36</td>
<td>13.29</td>
<td>58.15</td>
</tr>
<tr>
<td>6+ F2F</td>
<td>78.98</td>
<td>11.41</td>
<td>68.11</td>
</tr>
<tr>
<td></td>
<td>75.48</td>
<td>8.56</td>
<td>67.43</td>
</tr>
</tbody>
</table>

*Note.* F2F refers to the traditional face-to-face classes.
Increased study hours per week yielded slightly increasing means for the initial medical terminology exam scores for participants in the face-to-face instructional format, but no appreciable differences were apparent in the means from the online instructional format for the initial scores. For the repeated medical terminology final exam means, increased study hours did not result in increasing means.

Although a multiple regression analysis of data was originally planned to investigate the Research Question, the analysis could not be adequately addressed because of substantial uneven distribution of the sample across demographic categories.

Research Hypothesis 1

For Research Hypothesis 1, “Medical terminology performance scores differ based on instructional format,” a one-way ANOVA statistical analysis was conducted. Descriptive statistics indicate that of the sample group, 61 reported completion of the medical terminology course in the traditional or face-to-face setting while 29 reported completion of the medical terminology course in the online setting.

The mean of the medical terminology final exam scores of the face-to-face medical terminology sections was 78.31 with a standard deviation of 11.13. The mean of the medical terminology final exam scores of the online medical terminology sections was 70.79 with a standard deviation of 12.93; thus the final exam mean was higher for the face-to-face medical terminology course sections. Assuming homogeneity of variance, the results of the one-way ANOVA for Hypothesis 1 revealed that this difference was statistically significant, F (1,88) = 8.056, p =.006. Thus, the findings support Research Hypothesis 1 as shown in Table 5.
Table 5

*Class Format Effect on Medical Terminology*

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>1109.353</td>
<td>1</td>
<td>1109.353</td>
<td>8.056</td>
<td>.006</td>
</tr>
<tr>
<td>Within Groups</td>
<td>12117.677</td>
<td>88</td>
<td>137.701</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>13227.030</td>
<td>89</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* F2F refers to the traditional face-to-face classes.

Research Hypothesis 2

For Research Hypothesis 2, “Knowledge retention levels of medical terminology differ based on instructional format,” a medical terminology knowledge retention variable was calculated by comparing the means of the medical terminology final exam scores (FE1) with the repeated medical terminology final exam scores (FE2) using the following calculation: \( FE2 - FE1 = \text{Retention} \). A one-way ANOVA statistical analysis was then conducted to determine if this knowledge retention variable (Retention) is affected by instructional class format (ClassFormat).

The mean of the medical terminology knowledge retention variable of the face-to-face medical terminology sections was -10.01, indicating lower FE2 retained knowledge, with a standard deviation of 7.53. The mean of the medical terminology knowledge retention variable of the online medical terminology sections was -7.62 with a standard deviation of 6.45; thus, the knowledge retention mean was greater for face-to-face instructional formats of medical terminology course sections. With homogeneity of variance assumed, the results of the one-way ANOVA for Hypothesis 2
revealed that this difference was not statistically significant, F (1,88) = 2.164, p = .145.

The findings, therefore, do not support Research Hypothesis 2 as shown in Table 6.

Table 6

*Class Format Effect on Retention*

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>112.271</td>
<td>1</td>
<td>112.271</td>
<td>2.164</td>
<td>.145</td>
</tr>
<tr>
<td>Within Groups</td>
<td>4564.981</td>
<td>88</td>
<td>51.875</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4677.252</td>
<td>89</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Research Hypothesis 3

For Research Hypothesis 3, “Scores on medical coding final exam differ as a function of medical terminology class type, covarying medical vocabulary knowledge retention,” the analysis of data involved a two-step process. The first issue was to determine if instructional format of medical terminology affected coding outcome. The second issue was to assess the effect of class format while controlling for knowledge retention in order to establish that there were no Gaussian process differences in the covariate to determine if ANCOVA was appropriate.

Initially, a one-way ANOVA was utilized to determine if instructional format of medical terminology alone made a difference in the outcome of medical procedural coding scores. Assuming homogeneity of variance, the results revealed no statistically significant difference in coding based on instructional format, F (1,82) = 1.445, p = .233.

The findings failed to support the first question of Research Hypothesis 3 as shown below in Table 7.
Table 7

Class Format Effect on Coding

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>122.423</td>
<td>1</td>
<td>122.423</td>
<td>1.445</td>
<td>.233</td>
<td>.017</td>
</tr>
<tr>
<td>Intercept</td>
<td>545155.077</td>
<td>1</td>
<td>545155.077</td>
<td>6435.571</td>
<td>.000</td>
<td>.987</td>
</tr>
<tr>
<td>Class Format</td>
<td>122.423</td>
<td>1</td>
<td>122.423</td>
<td>1.445</td>
<td>.233</td>
<td>.017</td>
</tr>
<tr>
<td>Error</td>
<td>6946.192</td>
<td>82</td>
<td>84.710</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>625254.198</td>
<td>84</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>7068.615</td>
<td>83</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To directly address Research Hypothesis 3, an Analysis of Covariance (ANCOVA) was conducted to determine the possibility that knowledge retention impacted medical procedural coding. The knowledge retention variable (Retention) was used as the covariate, and the means were analyzed. The results of the analysis revealed that instructional format, covarying knowledge retention, did not impact the medical procedural coding means, $F(1,77) = .921, p = .340$. The findings did not support Hypothesis 3 that class format made a difference in coding as shown in Table 8.

Table 8

Class Format Effect on Coding, Covarying Retention

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>85.266</td>
<td>2</td>
<td>42.633</td>
<td>.494</td>
<td>.612</td>
<td>.013</td>
</tr>
<tr>
<td>Intercept</td>
<td>236120.607</td>
<td>1</td>
<td>236120.607</td>
<td>2733.333</td>
<td>.000</td>
<td>.973</td>
</tr>
</tbody>
</table>
Table 8 (continued).

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retention</td>
<td>12.964</td>
<td>1</td>
<td>12.964</td>
<td>.150</td>
<td>.700</td>
<td>.002</td>
</tr>
<tr>
<td>Class Format</td>
<td>79.597</td>
<td>1</td>
<td>79.597</td>
<td>.921</td>
<td>.340</td>
<td>.012</td>
</tr>
<tr>
<td>Error</td>
<td>6651.691</td>
<td>77</td>
<td>86.386</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>598315.482</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>6736.957</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Summary

Chapter IV included the results of the statistical analyses that addressed the research question and hypotheses of the research study. The results of the study indicate that for the research question, other factors in addition to instructional class format may affect the outcomes of medical terminology scores. For the research hypotheses, findings support the first research hypothesis that class format impacted medical terminology scores, but the results failed to support the second research hypothesis that class format affected medical vocabulary knowledge retention. Findings also failed to support the third research hypothesis that class format, covarying for knowledge retention, affects coding outcomes.

Chapter V includes a discussion of the findings, possible limitations, and implications and recommendations for additional study.
CHAPTER V
DISCUSSION

The focal purpose of this research study was to determine if instructional format of medical terminology courses affected the learning of medical vocabulary and ultimately the learning outcomes of medical procedural coding courses. The findings of this study also supported the examination of other factors that could potentially influence medical vocabulary knowledge retention and medical procedural coding success. With online learning at the height of popularity in postsecondary settings, identifying and examining identifiable correlations provide potential benefits and enrichment opportunities for instructional design in the healthcare data technology program. Face-to-face and online instructional formats present challenges to the instructor and student alike as high performance levels are recognized and required for workplace success after program completion.

Discussion of Findings

The continual aspiration of educators is to ensure successful learning outcomes whether instructional content delivery is by traditional methodology or online instruction. The popularity of online learning necessitates instructional designs that are grounded in proven learning theories and supported by research-driven pedagogy. The views of Vygotsky (1978), Bandura (1995), and Dewey (1910) pervade modern instructional design based on social constructivist learning where cognitive development is achieved through social settings such as distance learning.

This research study addressed learning medical terminology through online instruction compared with traditional instruction and specifically focused on medical
vocabulary mastery and its effect on medical procedural coding success. The views of Dewey and Bandura are enmeshed in learning the facts of medical vocabulary and the application of fundamental knowledge to more advanced skills such as medical coding. Adults engage in a more constructivist learning approach, a concept that also envelopes Vygotsky’s concept of learning.

To ensure the successful completion of the healthcare data technology program, mastery of basic skills, including medical terminology, and the application of acquired knowledge to coding are essential. Mergel (1998) believed that this process of mastery and application could be accomplished when course objectives are developed through adaptation of learning theories that support the desired learning outcomes. Mergel (1998) further purported that cognitive, behavioral, and constructivist paradigms produce positive learning outcomes when basic facts and knowledge must be learned and applied. The data that were collected and analyzed in this study addressed the following research question and research hypotheses.

*Research Question*

Research Question: Do other factors—age, ethnicity, gender, the number of hours devoted to study, childcare or family responsibilities, and the number of work hours—separately or in combination make a difference in medical vocabulary knowledge retention and the outcome of procedural medical coding? More than two-thirds of the participants completed the medical terminology course in the traditional setting. The ones who completed the course using an online platform, however, indicated a preference for the traditional classroom.
Students may decide to take courses online but still prefer the face-to-face instructional format where greater interaction with instructors is more likely. The findings of this study concur with Hirschy et al. that older students preferred traditional instructional settings over online environments. Findings for the Research Question also indicate that the research study participants were overall satisfied with their choices of instructional format for the medical terminology course. These findings parallel the results of Allen and Seaman’s (2011) study indicating equivalent student satisfaction ratings for online and face-to-face classes. Additionally, these current findings are consistent with the studies reported by Palmer and Holt (2009) that equate student satisfaction with achievement. Students who perform well in traditional classes are also likely to perform well in face-to-face classes regardless of their reasons for selection the nontraditional setting.

A multiple regression analysis was not conducted as previously planned because of a substantial uneven distribution of the sample across demographic categories. The great majority of respondents were female with Caucasians and African Americans comprising the majority of ethnic groups. Huang’s (2002) research identified community college students as older, employed, having dependents at home, female, and having varied personal work schedules. His study lends credence to the possible inability to gather data from the unrepresented groups of this study, raising the issue that a more diverse sample may not exist. This study’s participants correlate with Huang’s findings regarding the demographic makeup of community college students.
Research Hypothesis 1

Research Hypothesis 1: Medical terminology performance scores differ based on instructional format. Findings obtained through statistical analyses to address Research Hypothesis 1 suggest that instructional format affects the means of the medical terminology final exam scores, but only slightly. Even though the traditional class type yielded higher means, online means nevertheless indicated proficiency. Students who succeed in traditional courses also tend to succeed in online settings. The findings of this study are consistent with Harris and Parrish (2006), who state that the main difference in online and face-to-face instruction is the manner in which communication occurs, not learning outcomes. Furthermore, this study agrees with Bradley (2011) who found that learning outcomes for online and traditional classes are about the same. Providing practical avenues for communication in online classes will create communities of learners where isolation is avoided and interaction is encouraged.

Research Hypothesis 2

Research Hypothesis 2: Knowledge retention levels of medical terminology differ based on instructional format. Findings for Research Hypothesis 2 demonstrate that medical vocabulary knowledge retention was not affected by instructional format and that retention of medical terminology decreased. The negative retention means indicate that knowledge retention diminished between the initial testing and the repeated testing in medical terminology in both traditional and online classes. Time had elapsed between pre- and posttest which suggests that knowledge retention may be affected by delayed testing. Ensuring that the medical vocabulary and coding knowledge base is channeled from short-term to long-term memory promotes successful outcomes for learners.
Retention of factual knowledge until its application to learning new skills needs scrutiny, especially when programs must be completed within a short time span. Offsetting the loss of knowledge retention from a prerequisite course would be invaluable when subsequent courses begin with the same knowledge base. A previous study by Bloom (2009) suggests that utilizing collaborative testing allows improvement of students’ retention of course content. While the findings of this study do not directly parallel this view, consideration for this concept may be in order. Because the deficiency in knowledge retention could ultimately affect outcomes of other courses, suggested alternatives to the loss of retention would be helpful.

*Research Hypothesis 3*

Research Hypothesis 3: Scores on medical coding final exam differ as a function of medical terminology class type, covarying medical vocabulary knowledge retention. Findings for Research Hypothesis 3 signified that instructional format, factoring for medical vocabulary knowledge retention did not affect procedural coding proficiency. Interestingly, this study revealed higher means of the coding exam scores than the means of medical terminology exam scores. Constant review of medical vocabulary in the coding courses could explain the higher means, however.

Research has shown that few differences exist between distance learning performance and traditional classroom performance with regard to proficiency. An interesting point, however, is that while individuals tend to prefer traditional face-to-face instructional formats, they continue to gravitate toward the online environment. The findings formulated from research studies and presented in the research literature also support this phenomenon. For this reason, instructional content for distance learning
courses should be strengthened in whatever manner is deemed necessary to address any deficiencies in learning outcomes.

Online enrollment continues to increase by as much as 10% annually (Allen & Seaman, 2011); therefore, the concerns associated with providing quality and sustainable learning results remain constant. The rhetoric of Johnson and Aragon (2002) is still significant a decade later. They believe that creating a community of learners who are motivated to complete assignments and addressing individual differences through communication are essential to distance learning success. The findings of this research study are consistent with Johnson and Aragon’s belief that while class format affects medical terminology outcomes it has no bearing on coding outcomes. Findings of higher coding test score means than medical terminology means lend support to the study conducted by Boerema, et al., (2007) who found that prior knowledge leads to sequential learning.

Conclusions

This researcher believes that learning is a complicated and continuous process involving cognitive, behavioral, and constructivist learning modalities. While traditional learning environments are preferred by the majority of learners, online course offerings continue to be designed and offered at all educational institutions and educational levels. The number of online courses and the number of online students seem to be plateauing, although online instructional design remains a robust topic of instructional dialogue and planning.

As a result of the findings pertaining to the research question and hypotheses, this research concludes that online and traditional class formats realize about the same
learning outcomes, that other factors besides class format impacts learning outcomes, that knowledge retention is decreased over time unless constant application to advanced skills is practiced, and that sequential learning is supported by foundational knowledge and may actually increase as factual knowledge decreases.

As was indicated in this research study, individuals prefer traditional instructional formats yet often select online courses. The findings of this study concur with the opinions of other researchers that successful learning depends to a great extent on students’ self-efficacy (Burney, 2008; Ying et al., 2008), innate motivation (Lei, 2010; Xie & Ke, 2011), and personal preferences and satisfaction (Johnson & Aragon, 2002) regardless of instructional format. Identifying the learner’s reason for enrolling in community college programs could provide positive insight into steering students toward successful completion. Hirschy et al. (2011) contend that institutions must address the barriers to completion to offset the high attrition rates often associated with the technical programs.

The findings of this research study are consistent with the idea of Collard et al. (2009) that factual knowledge, such as learning medical vocabulary, may actually decrease as application of the knowledge increases, such as learning medical procedural coding. The increased means of the coding variable when compared with the means of the medical terminology exam scores lend support to this view.

As the popularity of online delivery remains a constant and mainstreamed educational option, online instructional design should be developed based on sound learning ideology and anticipated learning outcomes. Online content must not be a duplicate of traditional course content but rather planned to incorporate diverse
composition and interactive learning opportunities. While this research study supports the views that learning can be achieved online, the question remains as to which students do better online and when is the learning compromised for the convenience of the learner.

Limitations and Implications

The first potential limitation of this study is the sample size and that the sample represented only one institution. To enhance the findings, additional studies at other community college healthcare data technology programs in the southeast would be in order. A larger sample size would determine if similar findings could be replicated or additional findings could be discovered. A second possible limitation is demographics that would involve a more diverse sample that could include more representative participant characteristics such as cultural traits, increased ethnic participation, and equality of genders. The third limitation is that the questionnaire could have been designed to include the reasons why students enroll in a particular instructional format, rather than only obtaining their opinions regarding choice of formats.

Despite these limitations, however, this study revealed interesting findings regarding the impact of instructional format in the learning outcomes of medical terminology and medical procedural coding and also supported the findings of various aspects of previous research studies. While the instructional format alone did not play a major role in coding outcomes, this study could be expanded to investigate other factors that lead to increased learning, especially coding proficiency.

The researcher’s intent was to create an increased awareness and understanding of proficiencies of students in the healthcare data technology field. Because of the popularity of the program at the community college involved in the study, as well as
other southeastern community colleges, student learning outcomes should be examined to ensure maximum learning results. With the number of potential healthcare job opportunities nationwide and the number of students involved in healthcare data technology programs throughout the state, students must be well-trained and equipped to meet employment standards to allow entry into the job market upon completion of the program.

Healthcare data technology programs should be continually evaluated for relevance to career preparedness, and instructors need to stay up-to-date regarding coding guidelines and annual changes associated with procedural coding. Students who are in training for a medical coding career require consistent practice in selecting and assigning codes while simultaneously reviewing the anatomy and physiology of the body systems.

National credentialing of medical billers and coders requires a thorough understanding and knowledge of all aspects of the billing and coding process, including anatomy and physiology. Ensuring that medical vocabulary proficiency and knowledge retention is accomplished regardless of instructional format is essential in improving course content and instructional design so that mastery may be guaranteed.

**Recommendations**

This study expands the view that online instruction continues to provide a viable option to campus-based courses. Research indicates that students actually prefer traditional instruction, but they persist in selecting online instructional formats. Instructors should strive to design online course content that meets high pedagogical standards, reflects students’ needs, and assures optimal learning. The adult learner brings
many experiences to the classroom (both online and traditional) and prefers interactions and applications associated with constructivist learning protocol.

Policy makers and institutional administrators are burdened with escalating costs of educating their students. Increasing enrollment by attracting students to the institutions is important while also increasing completion and graduation rates. The quantity of students and programs must not preclude the quality of instruction and ultimately the quality of the product that is created for the workforce.

Based on the findings of this research study, the following recommendations for additional studies, program enhancements, and policy changes are suggested. This study could be replicated in other technical and academic disciplines as well as other community colleges where online sections are offered to gauge learning proficiency and instructional design options to maximize learning outcomes. Studies could also be conducted that address students’ satisfaction ratings regarding a variety of online components, such as Discussion board posts, ePortfolios, testing, submitting files, and communication via synchronous chat rooms.

A study focusing on instructor opinion to determine the impact of other factors related to successful outcomes in online settings, such as class size, administrative support, technical support, communication with students, and content delivery, would provide further insight into content delivery and learning proficiency. A final suggestion is to develop a readiness mini-course that is required prior to enrolling in an online course. The course could include course management platform navigation, required computer competencies, and assessment of personal attributes that are essential for independent performance and self-motivation in distance learning.
Summary

Chapter V included a discussion of the findings of this research study, including the research question and research hypotheses. The researcher’s conclusions were also provided, along with comparisons of current findings to previous research studies. Limitations and implications of the study plus recommendations for future research were also presented.
APPENDIX A
PARTICIPANT CONSENT FORM
THE UNIVERSITY OF SOUTHERN MISSISSIPPI
AUTHORIZATION TO PARTICIPATE IN RESEARCH PROJECT

September, 2011 and June, 2012

Dear Participant:

The purpose of this research study is to compare the knowledge retention levels of students who completed Medical Terminology I online and in a traditional face-to-face classroom.

By agreeing to participate in this study, you will complete a medical vocabulary pretest and questionnaire, and agree to allow your Medical Terminology I Final Exam scores to be used as comparative data. You also agree to allow your CPT Coding Final Exam scores, if needed, to be collected for analysis in the Fall 2011 or 2012 semesters. The attached questionnaire covers ten issues related to your reasons for selecting the online instructional format or the traditional face-to-face instructional format as well as basic demographic variables. Completion of this questionnaire should take no more than 5 minutes. Please do not put your name on the questionnaire, but rather create a six-digit code as follows: Last 2 digits of your Social Security number plus last 4 digits of your MGCCC ID number. Data from the study will be aggregated, and a summary report may be used in a professional academic publication, presented at a professional conference, or as part of a larger study.

Although there may be no direct benefit to you as a result of your participation, the information that participants provide will be used to help inform decision making in planning instructional content for online and face-to-face courses, as well as strengthening the content of the current program. There are no known risks associated with participation other than the inconvenience of completing the pretest and questionnaire. Because no identifying information (except the code you created) is being collected and no individual results are being shared, it is not possible for anyone, including your instructor, to link your responses and scores to you.

Any information inadvertently obtained during the course of this study will remain confidential. Participation in this study is completely voluntary. Please feel free to decline participation or to discontinue your participation at any point without penalty, prejudice, or any other negative consequence.

To express appreciation for your participation, you will be entered in a drawing for a $25 gift card in December, 2011 (Group 1), and December, 2012 (Group 2).

Questions concerning the research, at any time during or after the project, should be directed to the researcher, Madelon Gruich, the research assistant, Donna Parker, Ph.D., or the chairperson of the dissertation committee, Shuyan Wang, Ph.D., at 601-266-5247. This project and this consent form have been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601) 266-6820.

Code of Participant____________________ Last 2 digits of SS# ___ ___
Last 4 digits of MGCCC ID# ___ ___ ___ ___
_______________________________(Research Assistant) ________________ (Date)
APPENDIX B

DEMOGRAPHIC AND OPINION QUESTIONNAIRE

QUESTIONNAIRE

Participant’s CODE
(last 2 digits of SS#; last 4 digits of MGCCC ID#)

1A) Gender: ____ female ____ male
1B) Age: _____21-25 _____26-30 _____31-35 _____36-40 _____41-older

2) Ethnicity:
____ Asian
____ American Indian
____ Hispanic/Latin American
____ Vietnamese
____ Black/African American
____ White/Caucasian (Non Hispanic)

3) Did you take Medical Terminology I in the classroom or online: ___ classroom ___ online

4) How many hours per week did you work at a paid job during the semester you took Medical Terminology I?
   ____ none ____ 1-5 ____ 6-10 ____ 11-15 ____ 16-20 ____ 21-30 ____ 31-40

5) Did you have child care responsibilities during the semester that you took Medical Terminology I that sometimes conflicted with class?
   ____ yes ____ no

6) Approximately how many hours per week did you devote to studying Medical Terminology I?
   ____ none ____ 1-2 ____ 3-4 ____ 5-6 ____ more than 6

<table>
<thead>
<tr>
<th>Respond to the following statements based on whether you took Medical Terminology I in the classroom or online.</th>
<th>strongly disagree</th>
<th></th>
<th></th>
<th></th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>7) Learning medical terminology was difficult because of the format I selected.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8) The format I chose had no impact on the degree to which I learned medical terminology.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9) The content and materials provided in this format adequately met my needs as a learner.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10) I would learn medical terminology more easily in a Traditional face-to-face setting.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11) I would retain medical terms and their definitions better if I spent more time studying.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12) Compared to other courses in the program, this course was very challenging.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13) I prefer traditional classes rather than online classes.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>14) There is no difference in instruction between online and traditional classes.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15) I made a good decision about the format chosen for Medical Terminology I and would make the same decision again.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16) I would recommend that students take Medical Terminology in the format I selected.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
APPENDIX C

INSTITUTIONAL REVIEW BOARD
APPROVAL TO CONDUCT RESEARCH (Independent Study)
THE UNIVERSITY OF SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147|Hattiesburg, MS 39406-0001
Phone: 601.266.6820|Fax: 601.266.4377|www.usm.edu/irb

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21CFR26, 111), Department of Health and Human Services (45CFR Part 46), and university Guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the “Adverse Effect Report Form”.
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER:  C11080902
PROJECT TITLE:  Knowledge Retention of Medical Vocabulary Based on Instructional Formats:  Indicator of Medical Coding Success (Independent Study)
PROJECT TYPE:  New Project
RESEARCHER/S:  Madelon Reed Gruich
COLLEGE/DIVISION:  College of Education & Psychology
DEPARTMENT:  Curriculum, Instruction, & Special Education
FUNDING AGENCY:  N/A
IRB COMMITTEE ACTION:  Expedited Review Approval
PERIOD OF PROJECT APPROVAL:  08/09/2011 to 08/08/2012

Lawrence A. Hosman, Ph.D.
Institutional Review Board Chair
APPENDIX D

INSTITUTIONAL REVIEW BOARD
APPROVAL TO CONDUCT RESEARCH (2011-12)
THE UNIVERSITY OF SOUTHERN MISSISSIPPI

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21CFR26, 111), Department of Health and Human Services (45CFR Part 46), and university Guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the “Adverse Effect Report Form”.
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: C11080902
PROJECT TITLE: A Comparison of Knowledge Retention Levels of Medical Vocabulary in Online and Traditional Instructional Formats
PROJECT TYPE: Change to a Previously Approved Project
RESEARCHER/S: Madelon Reed Gruich
COLLEGE/DIVISION: College of Education & Psychology
DEPARTMENT: Curriculum, Instruction, & Special Education
FUNDING AGENCY: N/A
IRB COMMITTEE ACTION: Expedited Review Approval
PERIOD OF PROJECT APPROVAL: 03/21/2012 to 03/20/2013

Lawrence A. Hosman, Ph.D.
Institutional Review Board Chair
APPENDIX E

INSTITUTIONAL REVIEW BOARD
APPROVAL TO CONDUCT RESEARCH (2012-13)
THE UNIVERSITY OF SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147|Hattiesburg, MS 39406-0001
Phone: 601.266.6820|Fax: 601.266.4377|www.usm.edu/irb

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21CFR26, 111), Department of Health and Human Services (45CFR Part 46), and university Guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the “Adverse Effect Report Form”.
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: C11080902
PROJECT TITLE: A Comparison of Knowledge Retention Levels of Medical Vocabulary in Online and Traditional Instructional Formats
PROJECT TYPE: Previously Approved Project
RESEARCHER/S: Madelon Reed Gruich
COLLEGE/DIVISION: College of Education & Psychology
DEPARTMENT: Curriculum, Instruction, & Special Education
FUNDING AGENCY: N/A
IRB COMMITTEE ACTION: Expedited Review Approval
PERIOD OF PROJECT APPROVAL: 06/26/2012 to 06/25/2013

Lawrence A. Hosman, Ph.D.
Institutional Review Board Chair
APPENDIX F

MISSISSIPPI GULF COAST COMMUNITY COLLEGE
APPROVAL TO CONDUCT RESEARCH (2011-12)
APPENDIX G

MISSISSIPPI GULF COAST COMMUNITY COLLEGE
APPROVAL TO CONDUCT RESEARCH (2012-13)
APPENDIX H
DATA COLLECTION PROCESS

Group 1: Data Collection Fall Semester 2010 to Fall Semester 2011

Medical Terminology class sections (Online and Face-to-Face)

Step 1:

Medical Terminology Final Exam 1 (FE1)

Medical Procedural Coding class sections

Step 2:

Medical Terminology Final Exam 2 (FE2)

Step 3:

Demographic & Opinion Questionnaire

Step 4:

Medical Coding Final Exam (Coding)

Group 2: Data Collection Fall Semester 2011 to Fall Semester 2012

Medical Terminology class sections (Online and Face-to-Face)

Step 1:

Medical Terminology Final Exam 1 (FE1)

Medical Procedural Coding class sections

Step 2:

Medical Terminology Final Exam 2 (FE2)

Step 3:

Demographic & Opinion Questionnaire

Step 4:

Medical Coding Final Exam (Coding)
# APPENDIX I

## TABLE OF FREQUENCIES OF PARTICIPANTS’ SATISFACTION REGARDING SELECTION OF INSTRUCTIONAL FORMAT OF MEDICAL TERMINOLOGY COURSE

**Frequency of Participants’ Satisfaction Regarding Selection of Instructional Format of Medical Terminology Course**

<table>
<thead>
<tr>
<th>Statements</th>
<th>Disagree 1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Agree 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Learning medical terminology was difficult because of the format I selected.</td>
<td>54</td>
<td>21</td>
<td>9</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2. The format I chose had no impact on the degree to which I learned medical terminology.</td>
<td>20</td>
<td>17</td>
<td>19</td>
<td>9</td>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td>3. The content and materials provided in this format adequately met my needs as a learner.</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>18</td>
<td>56</td>
</tr>
<tr>
<td>4. I would learn medical terminology more easily in a traditional face-to-face setting.</td>
<td>9</td>
<td>5</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>45</td>
</tr>
<tr>
<td>5. I would retain medical terms and their definitions better if I spent more time studying.</td>
<td>5</td>
<td>3</td>
<td>11</td>
<td>19</td>
<td>14</td>
<td>41</td>
</tr>
<tr>
<td>6. Compared to other courses in the program, this course was very challenging.</td>
<td>16</td>
<td>7</td>
<td>26</td>
<td>23</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>7. I prefer traditional classes rather than online classes.</td>
<td>6</td>
<td>8</td>
<td>15</td>
<td>12</td>
<td>12</td>
<td>40</td>
</tr>
<tr>
<td>8. There is no difference in instruction between online and traditional classes.</td>
<td>46</td>
<td>18</td>
<td>16</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. I made a good decision about the format chosen for Medical Terminology and would make the same decision again.</td>
<td>6</td>
<td>3</td>
<td>9</td>
<td>5</td>
<td>17</td>
<td>53</td>
</tr>
<tr>
<td>10. I would recommend that students take Medical Terminology in the format I selected.</td>
<td>5</td>
<td>3</td>
<td>9</td>
<td>9</td>
<td>19</td>
<td>48</td>
</tr>
</tbody>
</table>
APPENDIX J

TABLE OF MEANS OF PARTICIPANTS’ SATISFACTION REGARDING SELECTION OF INSTRUCTIONAL FORMAT OF MEDICAL TERMINOLOGY COURSE

<table>
<thead>
<tr>
<th>Statements</th>
<th>Face-to-Face</th>
<th>Online</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Learning medical terminology was difficult because of the format I selected.</td>
<td>1.67</td>
<td>2.00</td>
</tr>
<tr>
<td>2. The format I chose had no impact on the degree to which I learned medical terminology.</td>
<td>2.81</td>
<td>4.30</td>
</tr>
<tr>
<td>3. The content and materials provided in this format adequately met my needs as a learner.</td>
<td>5.13</td>
<td>5.27</td>
</tr>
<tr>
<td>4. I would learn medical terminology more easily in a traditional face-to-face setting.</td>
<td>5.17</td>
<td>3.23</td>
</tr>
<tr>
<td>5. I would retain medical terms and their definitions better if I spent more time studying.</td>
<td>4.79</td>
<td>4.47</td>
</tr>
<tr>
<td>6. Compared to other courses in the program, this course was very challenging.</td>
<td>3.35</td>
<td>3.43</td>
</tr>
<tr>
<td>7. I prefer traditional classes rather than online classes.</td>
<td>4.97</td>
<td>3.40</td>
</tr>
<tr>
<td>8. There is no difference in instruction between online and traditional classes.</td>
<td>1.78</td>
<td>2.76</td>
</tr>
<tr>
<td>9. I made a good decision about the format chosen for Medical Terminology and would make the same decision again.</td>
<td>5.13</td>
<td>4.63</td>
</tr>
<tr>
<td>10. I would recommend that students take Medical Terminology in the format I selected.</td>
<td>5.37</td>
<td>3.97</td>
</tr>
</tbody>
</table>
REFERENCES


Ingenix (www.ingenixonline.com)


