CLINICAL PERSONNEL'S PERCEPTIONS ON USING INTERACTIVE APPLICATIONS FOR ONLINE COMPETENCY TESTING

A Dissertation Presented to the
Faculty of the College of Education
University of Houston

In Partial Fulfillment
of the Requirements for the Degree

Doctor of Education

by

Juan Jose Perez

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ABSTRACT

This study explored the perceptions of clinical personnel on the use of an interactive application within a Personal Interactive Information Management Site (PIIMS) (Perez, 2011). The interactive application selected for this study was Modular Object-Oriented Dynamic Learning Environment (MOODLE), an interactive application for online educational activities. PIIMS served as the internet desktop or central network location for the information and application. The study tested MOODLE managed within PIIMS, as a feasible means of developing and administering online competency testing. The descriptive research study assessed the perceptions of laboratory personnel using the interactive application. A 36-item computer-based survey was designed and administered to 55 participants using PIIMS. Factor analysis of the responses revealed three latent factors labeled preference, usefulness, and self-efficacy. The labeling of the three latent factors of perception was based on the theme related to each item and their strong primary loading. Furthermore, the analysis of the data indicated participants preferred using an interactive application for online competency testing over traditional methods, felt competent using the online method, and considered it more useful than other methods. Given the rate at which technology and information is evolving, it is important that we gain insight on the attitudes of using interactive applications within a central network location such as PIIMS for competency testing and information management.

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Chapter I

Introduction

Competency testing in the clinical laboratory has not kept up with new, evolving instructional technologies. Adapting to this changing environment, an important step is to gauge lab technician attitudes toward using a Modular Object-Oriented Dynamic Learning Environment (MOODLE) within a Personal Interactive Information Management Site (PIIMS) for clinical laboratory online competency testing. This research surveyed clinical personnel's perceptions on using an interactive application MOODLE, managed within a Personal Interactive Information Management Site (PIIMS) (Perez, 2011), to develop, administer, and effectively manage online clinical laboratory competency testing.

Competency testing is a requirement for all laboratory personnel working in a clinical laboratory. Various governmental and professional organizations are responsible to insure annual competency testing is conducted by all organizations engaged in clinical laboratory activities. Currently, the traditional methods of competency testing used in clinical laboratories are outdated and ineffective (Haun, Leach, & Vivero, 2000).

A method for practical and efficient competency testing is important for the medical laboratory field, making identifying and surveying interactive competency testing methods an important aim (Haun et al., 2000). The clinical laboratory is a significant part of the total health care provided to patients. About 70 percent of all medical diagnoses are made using laboratory results (Mayo School of Health Sciences, 2009). The Clinical Laboratory Improvement Act of 1988 (CLIA) mandates competency testing be completed annually by all employees routinely performing clinical testing. In

addition, competency testing is also required by the College of American Pathologists (CAP) and the Joint Commission on Accreditation of Health Organizations (JCAHO).

Many tests in a clinical laboratory consist of two parts, a manual part and a microscopic part. Current methods of competency testing assess a technologist's ability to accurately report results by having the technologist manually perform the first part of the clinical test and then review a hand-out of pictures illustrating different types of elements found in the microscopic portion of the test. The answers are then graded by comparing them to results obtained by other technologists and established criteria. However, performing, preparing, preserving, and grading this type of assessment is time consuming. If test administration and grading were integrated into an online interactive computer-based program, eliminating preparation and preservation of the test samples, employees and supervisors would have more time to devote to patient care. According to previous research, online computer-based competency testing is more consistent, efficient and effective compared to the more traditional methods of competency testing (Aston et al., 1999).

Purpose of the study

The purpose of this study was to evaluate clinical laboratory personnel's perception of using interactive applications such as MOODLE within PIIMS for online competency testing. A survey was developed and administered online to clinical laboratory personnel working in various departments in a clinical laboratory. This survey gathered data on the dimensions of perception about MOODLE as an interactive online competency testing and information management tool. The findings of this study are

expected to contribute to future development of more effective and efficient interactive testing models within PIIMS for online competency testing.

Research Question

What are clinical laboratory personnel's perceptions concerning the use of interactive applications such as MOODLE to develop, administer, and manage online competency testing?

This was a descriptive research study that measured clinical personnel's perceptions about using the interactive application MOODLE for competency testing. I anticipated that the clinical laboratory personnel surveyed would have a positive opinion on three possible factors; preference, usefulness, and self-efficacy of using interactive applications such as MOODLE within PIIMS to develop, administer, and manage online competency testing in a clinical laboratory.

Chapter Summary

This chapter outlines the main point of this research. MOODLE was used within a PIIMS which was designed to meet an individual's need for information management. The survey used was designed, developed and administered online within PIIMS. The research question concerns the perception of laboratory personnel on the use of MOODLE within PIIMS for designing, administering, and managing online computer-based competency testing.

Chapter II

Review of Literature

Introduction

The purpose of this study was to gather data on perceptions for using MOODLE to administer competency testing. The study group consisted of clinical laboratory personnel working in the Texas Medical Center located in Houston.

This chapter provides a review of literature that is relevant to the purpose of this study and to the research questions. The review provides a description of the different type of clinical laboratory personnel and their job description. It also contains a brief account on the different type of agencies responsible for monitoring and regulating competency testing in clinical laboratories. The review also contains information on computer-based instruction and testing. Competency testing is also reviewed because it is an important part of this study. A brief review of online surveys, PIIMS, MOODLE, and designed was also carried out. This chapter also discusses the implications and justifications for the survey.

Clinical Laboratory Personnel

Clinical Laboratory Personnel (CLP) are professional workers certified and trained to work and perform diagnostic testing in a clinical laboratory (Bruce, 1990). Various positions within a clinical lab depend on the individual needs of the laboratory. Although titles have changed, and may vary from location to location, the main elements of a clinical laboratory team include the laboratory director, technical/general supervisors, scientists/technologists, technicians and phlebotomists (Clinical Laboratory Improvement Amendments, 1998). These positions are summarized in Table 1.

Table 1.

Clinical Laboratory Personnel

Position	Education and Training	Responsibilities
Laboratory Director	Doctoral degree (e.g., MD or PhD) Board certification recommended	Directs and manages all lab operations and ensures quality patient care. Interprets test results, with consulting pathologist
Technical Supervisor	Doctoral degree (e.g., MD or PhD); may be Master's or bachelor's degree with experience Board certification recommended May be the same person as the lab director	Provides oversight of technical and scientific functions of the lab
General Supervisor	May be the same person as the lab director or technical supervisor Depending on lab and experience, MLS/MT or MLT/MLT may qualify	Provides oversight of day-to-day functions of the lab
Medical Technologist (MT) or Medical Laboratory Scientist (MLS)	Bachelor degree in medical technology/biological science or completion of accredited CLS/MT program. Licensure / certification may be required by employers	Performs routine tests; develops new test methods under supervision; performs quality control tests; becomes group or team leader; supervises, teaches, delegates
Medical Laboratory Technician (MLT) or Clinical Laboratory Technician (CLT)	Associate degree and completion of accredited CLT/MLT or certificate program Licensure/certification may be required by employers	Performs routine tests and quality control tests under supervision of MLS/MT
Specialized Fields		
Cytogeneticist	Doctoral degree (e.g., MD or PhD) and board certification	Performs cytogenetic analyses to diagnose chromosomal abnormalities in human genetic diseases

Cytogenetic Technologist	Bachelor degree (B.A. or B.S) in the sciences or medical technology MLSp(CG) certification recommended	Prepares biological specimens for cell culture and microscopic analyses as part of cytogenetic studies; assists the cytogeneticist
Cytotechnologist (CT)	Bachelor degree and completion of accredited CT program	Examines human cells under microscope for signs of pathology (e.g., Pap smears for signs of cancer); with appropriate experience, may supervise a cytology laboratory
Histotechnologist (HTL) or Histologist	Bachelor degree and completion of accredited HTL program	Prepares tissue samples for microscopic examination by pathologist and performs complex procedures; can supervise histology technicians and, with appropriate experience, may supervise histology laboratory
Histology technician (HT)	High school degree and completion of accredited histology program	Prepares sections of body tissues for microscopic examination by pathologist, processes tissue biopsies, assists histotechnologists
Phlebotomist (PBT)	High school degree and training or work experience	Collects blood samples from patients for lab tests

- Compiled from "Careers in Medical Laboratory Technology," published by the American Society for Clinical Pathology; "Clinical Chemistry: Partnerships in Healthcare" by the American Association for Clinical Chemistry; and the Association of Genetic Technologists.

Regulatory Agencies

Facilities that perform laboratory tests on human specimens for the purpose of diagnosis or treatment are required by federal law to have a CLIA certificate, which is renewed every two years. The requirements for staff and competency training differ slightly for the American Association of Blood Banks (AABB), the College of American Pathologists (CAP), the Clinical Laboratory Improvement Act of 1988 (CLIA), and the Joint Commission for Accreditation of Healthcare Organizations (JCAHO), for example,

AABB standards suggest use of proficiency testing, written and oral exams, and observance of daily work procedures for improve performance. CAP requires a sufficient work force with adequate documented training and experience to meet the needs of the laboratory with periodic evaluations. CLIA requires a mechanism for periodically evaluating the effectiveness of policies and procedures to ensure employee competence. JCAHO requires individual competency to perform tests safely and accurately and to prevent transfer of infection. Despite these subtle differences, all agencies agree that staff competency should be evaluated and reported regularly.

Computer-Based Instruction and Testing

Computer-Based Instruction (CBI) is instruction and testing in which the participants learn their particular area of work by carrying out their training and competency testing on a computer (Bures, Abrami & Amundsen, 2000).

In a meta-analysis of studies dealing with CBI in the health professions; achievement effects, adult learners' long-term retention, attitudes toward content, instructional method and computers were reviewed. Meta-analysis is a statistical method of combining the results of a number of different studies in order to provide a larger sample size for evaluation and to produce a stronger conclusion than can be provided by any single study (Arthur, Bennett, Edens, & Bell, 2003). The analysis consisted of 47 studies with 10 classified as allied health studies. In 32 of the studies, students using CBI had a higher examination average. In the studies where effect size could be determined, students using CBI scored at the 66^{th} percentile of the students in the conventional group (Cohen & Dacanay, 1992). Bruce (1990) found that in clinical laboratory science

computer-assisted instruction is more effective than a correspondence course and as effective as a workshop in providing continuing education.

Early research studies on computer-based instruction compared it with teacher led instruction. The studies tended to view the computer as an independent variable and assumed that the computer itself was affecting the learning process (Thompson, Simonson, & Hargrave, 1993). Current research is more focused on the computer environment and how it has the potential for improving students problem solving and critical thinking. Research that focuses on the computer environments takes into consideration the interactivity provide by computer applications and not just static information. The new interactive computer environments are promoting more active and individualized learning on the part of the students as well as encouraging teachers to act as facilitators instead as the sage on stage.

Advantages of interactive computer-based instruction includes the ability to reach a much wider audience, the learner's control of pacing and approach, flexibility in instructional methodology, and assessment. However, the effectiveness of interactive computer-based instruction depends on adhering to proper educational theory on developing proper pedagogical delivery of instruction and testing.

Perceived disadvantages of interactive computer-based instruction are as follows:

1. It is not as effective as having an actual person teach; CBI studies do not compare equal teaching methods because the resources do not have the pedagogical strategies or knowledge content. (Prewitt, 1998).
2. It is perceived as impersonal and fails to identify learners or learning tasks for which CBI may be most appropriate. (Lawson, 1999).

3. There is no significant difference between the level of learning in computer-based instruction and the traditional or standard method. CBI users usually devote more time to the common learning goal than their peers so any improvement in performance was due to more effort and not something inherently better in using computers to teach. (Williams & Zahed, 2005).

Competency Testing

To effectively assess employee competency, a method must be designed, developed, and implemented that covers all aspects of the testing process, addresses the core abilities and knowledge bases, is consistently applied to all personnel who have technical as well as nontechnical roles, and is administered in an educational environment. Covered areas include *employee instruction,* covering the theoretical and practical aspects of the testing; *theoretical testing*, addressing whether employees understand the theories behind methods, instruments, policies, and procedures; *practical observation*, directly observing the employee's testing of samples, assessing mechanical techniques, judgment, decision-making processes, and communication skills; and *documentation*, insuring the results of competency testing are documented and retained for compliance purposes and employee feedback.

However, there are significant drawbacks to the current system of testing. A good example is the urinalysis competency test. Reading the microscopic part of the test is subjective, which makes it difficult to develop a reliable and valid assessment method. Establishing written standardized grading criteria would help eliminate the subjective nature of grading microscopic test responses. The improvement in computer images and technology makes it feasible to use standardized color images of actual slides. In

addition, an employee in the current system submits a written response to test materials and then waits for the employer to grade it. Interactive computer-based competency testing would allow not only for a more efficient and effective means of presenting and grading test materials, but can also provide the education and documentation through links.

Online Surveys

In recent years, computer-assisted self-interview (CASI) software has started to replace the paper and pencil self-administered questionnaires (SAQs) in psychological and behavioral research. CASI provides a number of potential benefits over traditional paper and pencil methods (Schroder & Carey, 2003); however, its cost is often prohibitive. The uses of online surveys to gather facts, assess perceptions, and so on, are expanding along with the developing technology of computers and the internet. Today a research participant can be given a hyperlink to a website where the survey, incorporating multi-media graphics and sound, is administered. However, researchers in various disciplines are unaware of advantages and disadvantages associated with conducting online surveys for their unique field.

Concerns about using Internet-based surveys include whether they are scientifically valid and also how to best conduct them. The e-mail survey was utilized before the widespread use of the web in the late 1980s. The e-mail had the advantage of nearly instantaneous delivery to the recipients and also the avoidance of postal costs. The e-mails were simple and text-based, which limited their length and scope. The major advantage at the time was the decrease in delivery and response time (Schonlau, Fricker, & Elliott, 2002). By the mid-1990s Internet survey began to replace the e-mail survey. It

became the preferred choice because it was easy to put into practice, it provided a friendlier interface with the respondent, and it offered the use of multimedia such as audio and video. One major advantage of computer-based surveys is that the computer automates the data entry phase of a survey. This increases the accuracy of data entry and saves time and cost in collating.

Surveys are useful in gathering data on people's perceptions, opinions, knowledge, attitudes, and behavioral intentions (Kelley, Clark, Brown, & Sitza, 2003). Four main reasons for conducting surveys are (a) to gather information and data, (b) to provide opportunity to discuss key topics about the target population, (c) to make sound data-driven decisions, and (d) to provide a benchmark.

PIIMS and MOODLE

Given the complexity and diverse nature of the various competency testing components, it seems clear that the efficiency of these tasks can be significantly improved by integrating them into an interactive computerized system. PIIMS and MOODLE are integrated systems designed for this purpose.

PIIMS manages, distributes, and gathers data, while MOODLE is an interactive application designed for educating and testing. MOODLE is a global development project designed to support the theory of a social constructionist framework of education. PIIMS is a Personal Interactive Information Management Site that bridges the gap between information management and information managers. It brings information and applications together for better management of both, allowing for the control of information and applications in a central location. It provides autonomy and

independence from advertisement and providers of internet sites. It is an individual's personal means of interacting with the internet.

PIIMS is not a software application it is an interactive website method used to manage information and applications. PIIMS was designed and developed in an environment created with the aid of ColdFusion and Dreamweaver. PIIMS can serve as a central network location capable of linking with interactive applications such as MOODLE. It can be used to collect data from interactive applications and deposit the data into a Microsoft Access database located on a server. It can collect data by way of a client desktop or the internet. Information and data can be linked to PIIMS for easy retrieval from the database for display. (For details on the development and design of PIIMS see Perez, 2011.)

ColdFusion is a programming language based on standard HTML (Hyper Text Markup Language) that is used to write dynamic web pages that connect to a database located on a server. This is the main programming language that was used to create PIIMS for this research paper. It is an application platform used for developing and delivering applications. Creating an application with ColdFusion is as easy as creating a static website; the difference is that in a ColdFusion application you can introduce a large range of functionality that are not available either in static websites or in traditional client/server applications. Using ColdFusion to create the computer based competency test allows the designer the ability to use a large number of the functions. The design allows for the creation of a dynamic advance organizer page that provides the user with information and materials to help him/her recall prior knowledge that will assist him/her on successfully completing the competency test. In addition it provides the designer the

ability to collect responses and answers to both surveys and competency tests. ColdFusion allows the designer to create dynamic pages that display images, collects data, and stores the information on a database through the internet for further manipulation. A ColdFusion interactive website application is a collection of pages, similar to a static website. The pages in a ColdFusion interactive website application include the server-side ColdFusion Markup Language (CFML) in addition to HTML. CFML allows the ability to control the applications, integrate a wide range of server technologies, and dynamically generate the content that is returned to the Web browser. ColdFusion is one of the best ways to create dynamic web pages that link to just about any database.

ColdFusion was introduced by Allaire Corporation in 1996, acquired by Macromedia in a merger in April 2001, and acquired by Adobe in December 2005. As a commercial product, it has some features different from other server side scripting languages. One major difference is that ColdFusion costs money. A server side scripting language works with an interpreter. Depending on the extension of the filename to be served, .php .asp or .cfm, the server will first send the file to an interpreter which is what dynamically generates your page. So to use these languages you need to install them on your server. PHP is free, ASP is free, but CF costs money, and that may be the reason why it is growing slowly. However, most NT (New Technology) hosting packages do already include ColdFusion, therefore, for the person who does not own their own server the pricing difference will not have much effect.

As a language, Cold Fusion is easier to learn and use then ASP and PHP. ColdFusion pages consist of standard HTML tags such as <FONT SIZE=.+2.>, together

with CFML (ColdFusion Markup Language) tags such as <CFQUERY>, <CFIF> and <CFLOOP>. CFML allows for the ability to control the behavior of the applications, integrate a wide range of server technologies, and dynamically generate the content that is returned to the Web browser.

When a page in a ColdFusion application is requested by a browser, it is automatically pre-processed by the ColdFusion application server. Based on the CFML in the page, the application server executes the application logic, interacts with other server technologies, and then dynamically generates an HTML page which is returned to the browser (Smith, 2008).

Dreamweaver is an Adobe application for designing and developing websites. Dreamweaver is available for Windows and Macs operating systems; recent versions now support web technologies such as server-side scripting languages including ASP, PHP, and ColdFusion. Using ColdFusion and Dreamweaver allows the user to creation a ColdFusion Dreamweaver environment in which it is possible to design and develop interactive websites.

PIIMS was used to create the survey for this study and to gather the data. The data was gathered online via the survey, and the answers were then transferred into a Microsoft Access database for analysis. MOODLE was the interactive application used to create the actual competency testing along with the instructional materials.

PIIMS and MOODLE materials were developed using the instructional design method of analysis, design, development, implementation, and evaluation (ADDIE) (Strickland, 2006). This involves the following techniques: First***, analyze*** the needs. Second, ***design*** instruction and presentations. Third, ***develop*** the materials. Fourth,

implement activities and courses. Last, ***evaluate*** participant progress and instructional materials effectiveness.

Instructional theories also play an important role in the design of instructional and testing materials. Theories such as behaviorism, constructivism, social learning and cognitivism help shape and define the outcome of instructional and testing materials (Liu, 2008). Behaviorism is the school of psychology which attempts to explain human behavior entirely in terms of observable and measurable responses to environmental stimuli. Constructivism is a viewpoint of holistic learning founded on the principle that, by reflecting on our experiences, we construct our own understanding of the world we live in. Each of us generates our own "rules" and "mental models," which we use to make sense of our experiences. Learning, therefore, is simply the process of adjusting our mental models to accommodate new experiences. Cognitivism is the study of how humans document and analyze information. The cognitivism view is that learning occurs internally and through the social interactions with others. It is the social interactions that trigger and assist the learning process as the learner makes internal connections between and among what has been observed and his or her experiences (Driscoll, 2005).

In the assessment phase, the instructional problem is clarified, the instructional goals and objectives are established and the learning environment and learner's existing knowledge and skills are identified. The design phase deals with learning objectives, assessment instruments, exercises, content, subject matter analysis, lesson planning and media selection. The design phase should be systematic, meaning it is logical and orderly in identifying, developing and evaluating the strategies for attaining the objective. It

should also be specific; the instructional design needs to be developed with attention to details.

The development phase is where instructional designers and developers create and assemble the content assets that were blueprinted in the design phase. In this phase, storyboards are created, content is written and graphics are designed. If computer-based instruction is involved, programmers work to develop and/or integrate technologies. Testers should address debugging procedures. The instruction design system is reviewed and revised according to feedback.

In the implementation phase, training the facilitators is initiated and should cover the course curriculum, learning outcomes, method of delivery, and testing procedures. This is the phase where the instructor ensures that the books, hands-on equipment, tools, CD-ROMs and software are in place, and that the learning application or website is functional.

The evaluation phase consists of two parts: formative and summative. It is the summative part that is relevant to the collection of data for this study. Formative evaluation is evaluated at each stage of the ADDIE process. Summative evaluation consists of tests designed for domain specific criterion-related referenced items and providing opportunities for feedback from the users (Strickland, 2006). Rothwell and Cookson (1997) claim that evaluation is the process of estimating value of a planned learning experience. It consists of two steps: (1) comparing results and objectives and (2) appraising or judging the value of the differences assessed. It involves evaluating what the results are and what they should be. The current project addresses the sixth step, evaluation, by exploring the perceptions of clinical personnel who actually use an

interactive application MOODLE. The data from the survey will be used to improve the design and development of the interactive competency testing and instruction. This information will also aid data-driven decisions, thus addressing the need for improved competency testing in the clinical laboratories.

Human Performance Technology (HPT) theories were also taken into consideration in the design of the competency testing and instruction materials used for this study. HPT is defined as a systematic approach for improving productivity and competence using a set of methods and procedures along with strategies for solving problems. More specific, it is a process of selection, analysis, design, development, implementation, and evaluation of programs to most cost-effectively influence human behavior and accomplishment. It is a systematic combination of three fundamental processes: performance analysis, cause analysis, and intervention selection (Industry Report, 2000).

Human performance in all fields and domains can be improved through properly designed human performance methods and educational methods of instruction. Gilbert (1996) asserts that a robust sub domain of study within instructional systems is human performance technology (HPT). HPT focuses on terminal performance as its unit of measure and explores three areas to seek leverage in improving performance; information, instrumentation, and motivation.

Human performance technology provides the means to increase productivity of the employees by improving their skills and knowledge. Similarly, I believe that using PIIMS can increase human performance by providing a means of competency testing that is less time consuming and also improves skills and knowledge. Just the fact that

employees will be using a computer and internet to take the competency test will increase their computer skills by having them navigate the site and take the test.

The use of PIIMS for competency is not only more productive but it also contributes to better management of limited resources in the current market of clinical laboratories. The U.S. organizations with 100 or more employees budgeted $54 billion on formal training of employees in 2000 (Industry Report, 2000). Reasons for evaluating human performance beside the marketplace are:

a) Accountability to the organization.

b) Evaluation on whether to continue or discontinue a program.

c) To gather information on how to improve and create new programs.

Bichelmeyer and Horvitz (2005) assert "the quintessential goal of every human performance technologist, as well as every educator, professional development specialist, corporate trainer, human resources professional, middle-level manager, corporate executive, psychologist, coach and self-help guru, is to create better human performance" (p. 1). Cicerone, Sassaman and Swinney (2005) declared that the success of the efforts to increase performance is decided by the theory that guides the evaluation of the performance.

Arthur et al. (2003) claim that individuals and organizations need for development is traced to numerous demands, including maintaining superiority in the marketplace, enhancing employee's skills and knowledge, and increasing productivity. Other areas of importance in designing and evaluating a training program are; needs assessment, the processes of analyzing the organization needs, objectives, and problems, to determine what training is necessary. The purpose is to specify the skills and tasks the employees

will need to meet the objectives of the program. "Cognitive skills and tasks are related to the thinking, idea generation, understanding, problem solving, or knowledge requirements for the job" (Arthur et al., 2003). In their research paper "Effectiveness of Training in Organizations: A Meta-Analysis of Design and Evaluation Features" they used meta-analytic procedures to examine the relationship between specific training design and evaluation features and effectiveness of organizational training. What they found was that the type of training method used, the skill or task characteristic trained, and the choice of training evaluation criteria are related to the observed effectiveness of the program.

Design

The process of design is not fully understood, probably because design is not narrow in scope and it involves many facets and theories of learning. Any attempt in mapping the process of design should be flexible and nonrestrictive, mimicking the complexity of the human mind and world. It must include skills common to all disciplines but also be broad enough to allow for specific skills related to individual disciplines. Likewise, the design of MOODLE within PIIMS for competency is meant to be flexible and nonrestrictive allowing for the innovation of a variety of applications and uses. Design can be described as a collection of related parts working together by way of a driving force to accomplish a particular task. A system design can be either simple or complex and is made up of many smaller subsystems.

Some researchers view design as the conception and realization of new things (Cross, 2001). Design involves the appreciation of material culture and the application of the arts of planning, inventing, making, and doing. Cross (2001) claims that design has its

own distinct things to know, way of knowing them, and ways of finding out about them. The development of MOODLE within PIIMS is the conception and realization of new ways of competency testing and information management and is at the core of design.

Intriguing is the concept that as humans when we create we are actually practicing design at its fundamental roots. Design is applicable to all aspects of the world we create around us as well as in the study of the world as it exists around us. A good definition for design is that it is the thinking process that occurs when creating a concept, theory, idea, object, and so on. Like others before them Nelson and Stolterman (2003) discuss design in a broad manner and not as a specific field or design such as interior design, information system design, physical design, healthcare design, etc. They promote the idea that design in itself is its own domain or tradition with its own fundamental core of ideas. The unifying elements as proposed by their article are foundation, fundamentals, and metaphysics. Foundation is the principles of design and fundamentals are the core concepts that are learned or improved. Metaphysics is the interaction of foundation and fundamentals. Design is viewed not just as creating but also as a profound function involving reflection, productive action, and follow through. The process of design is the means for the most effective and efficient way of accomplishing the task. Design is a basic human function that we practice daily to create our reality.

Implications

The availability of applications such as MOODLE, ColdFusion, Dreamweaver, and Access now makes it possible for almost anybody to design their own interactive site for competency testing. Designing and developing a private independent interactive site for competency testing endows the individual with autonomy and freedom of choice to

decide what and how information is consign to the site. One other advantage of an interactive website is the ability to present and gather the data for a variety of innovative uses. Designing a Personal Interactive Information Management Site and using MOODLE endows the individual with the ability to maintain and control the delivery and gathering of data. It allows for the collection of information to a private database. The information can later be made available for analysis and mining. The main advantage of MOODLE within PIIMS is the increase ability to present and gather data for multiple personal and professional projects. The individual is no longer a passive participant in Web 2.0 but the creator of his own site independent of commercial providers. MOODLE within PIIMS can be used in a variety of professional fields because of the flexibility, ease of use, and available tutorial resources on the internet. MOODLE within PIIMS can be used for competency testing in almost any field. MOODLE within PIIMS can be the resource for the delivery of online educational materials, testing, sign off documentation, and so on for many professions.

Justification for Survey

The survey gathered data on the perception of laboratory personnel on the use of an interactive application MOODLE within PIIMS for competency testing. Current methods of competency testing have been in use for many years. However, these methods of competency testing have become obsolete in this new era of instructional technologies. Due to the shortcomings of the manual methods they are high in both cost for materials and time. On this basis, the survey endeavors to gather data on the perceptions of clinical personnel on using the interactive application MOODLE within PIIMS for competency testing as a method for a more efficient and effective method of competency testing using

new instructional technologies. Hopefully, the results will provide information to other laboratories in need of more efficient and effective methods of competency testing to adopt new instructional technologies in the clinical laboratory environment.

Chapter Summary

This chapter reviewed clinical laboratory personnel, regulatory agencies responsible for laboratory competency testing, competency testing requirements, the present state of competency testing methods, the value of online survey methods, PIIMS, MOODLE, ADDIE, and justification for surveying the perceptions of clinical personnel on using an interactive application MOODLE.

Chapter III

Methodology

Introduction

The purpose of this study was to describe the perception that clinical laboratory personnel have for using MOODLE for competency testing in the clinical laboratories. As a result, this study addressed the research question: What are the perceptions of clinical laboratory personnel on using MOODLE to develop, administer, and manage online competency testing?

This chapter describes the methodology that was used to provide evidence of the existence of the three sub factors of perception. The chapter further describes (a) research design, (b) participants; (c) procedures; (d) survey; (e) data analysis, and (f) open-end questions.

Research Design

This study used survey data from clinical lab personnel to quantify perceptions about the interactive application MOODLE. Participants rated their perceptions with regards to preference, usefulness and self-efficacy of the interactive application MOODLE for developing, administering, and managing online competency testing, as compared to traditional methods.

Participants

Participants were 70 employees who work in a clinical laboratory at one of the major hospitals in the Texas Medical Center located in Houston. Of the 70 persons that were invited to fill out the survey, 55 filled out the survey. The hospital is one of the major hospitals in the Texas Medical Center. The participants are also representative of

similar numbers and type of staff in the clinical laboratories of these institutions. They represent managers, supervisors, technologists, laboratory liaison technicians and phlebotomists. The survey was intended to collect data from this convenient cohort selected from a predetermined population and collected at one point in time. The participants are representative of a larger group of laboratory personnel working in the Texas Medical Center. It is a convenient sample because the participants are employed at the same institution. The sample is limited and includes only participants that have taken the competency tests that I designed and developed using MOODLE. Competency testing using MOODLE was completed for the hematology department, chemistry department, coagulation department, urinalysis department and the specimen processing areas of the hospital laboratory. An e-mail list of potential participants working in the hospital and associated outside clinical locations was used.

Procedure

The sample group was invited by e-mail to participate in the study (See Appendix A). Included with the request to participate was five dollars or the equivalent in a McDonald's gift card as a token of appreciation to compensate all the participants for their time. The participants were asked to fill out an interactive survey linked to PIIMS. First, they clicked on a link in the email (http://www.macjuan.com) and were taken to the PIIMS website. On the website, clicking a button took them to the anonymous online survey. The survey took an average of 15 minutes to complete. When they finished taking the online survey they clicked "submit," and were thanked for their time and notified of their success on filling out the survey. The data was collected anonymously and assigned random numbers as identifiers for the purpose of analysis. The gift cards and money were

delivered to all invited participants by interdepartmental mail along with the consent form that was signed and returned whether they participated or not, so that anonymity was maintained.

Survey

I decided to conduct a computer-based survey because of the convenience of using this type of data collection method. I designed the survey using a *Dreamweaver* and *ColdFusion* environment. I collected that information in a Microsoft Access database. I decided to design and develop the survey instead of using one of the many free survey applications available on the internet because of the preference for full control of the final product and not relying on commercial generic products which limit the questions and versatility of the survey.

I designed the pilot survey in a previous study to measure the opinion of the respondents on the use of an interactive website for designing competency testing and information management (Perez, 2010). In order to design a high-quality survey I embarked on a comprehensive literature review of online surveys, creating surveys, and types of surveys. What I discovered was that for the pilot instrument on surveying the opinions of a cohort of laboratory personnel a 5 point scale would be appropriate. The research recommends using a 5 point scale to get opinions on a topic which are strongly positive, negative or neutral (See Appendix D). However, for this study the interest is on whether the participants have a positive or negative perception on using online interactive applications, so a 6 point scale was the appropriate instrument for this project (See Appendix E). A 6 point scale without a neutral choice would compel the participants to respond on whether their perception in using interactive applications for online

competency testing is positive or negative. For the pilot survey, I first created a survey of 52 items based on the best methods elicited from the literature review. Second, I administered the survey to a convenient sample of 22 participants to expedite the process and gather the required data. Initially, I developed over 100 items to survey the opinions of the cohort but finally decided on 52 items which I felt addressed the main construct of opinion and its four multidimensions of (a) preference, (b) worthiness, (c) self-efficacy and (d) perception. After gathering the data, it appeared that items that grouped together exhibited high loading on the same factor. I concluded that these items measured the same construct. I settled on three dimensions based on how the questions loaded on the rotated factor analysis and how they clustered after reverse coding the negatively stated questions. Although some items cross loaded the majority exhibited primary strong loading on only one factor. I combined my original dimensions of perception and worthiness into one dimension of usefulness. I did this because after examining the data a pattern emerged that seemed to cluster the questions into the dimension of usefulness. I decided on 30 items relative to the dimensions of (a) preference, (b) usefulness, and (c) self-efficacy for any future survey based on this research. Furthermore, the data collected indicated that by eliminating and modifying some of the questions on the survey a better set of data and results could be gathered

The questionnaire for this study contained 30 similarly scaled items, based on the pilot study survey, that reflect on the specific domains being surveyed using a 6-point scale ranging from "strongly agree" to "strongly disagree" with 6 indicating "strongly agree" and 1 "strongly disagree". The three dimensions of perception were expected to be (a) preference (b) usefulness and (c) self-efficacy. Included were reverse questions to

cancel out the bias of wanting to agree with everything; reverse items increase internal validity. A response set is the condition of mind in which a respondent answers a specific group of questions according to a conscious or unconscious bias. For example, if a respondent feels that a certain application is great, the respondent may give positive responses to all the questions related to that application without reading all the items carefully. Cox and Cox (2008, p.16) suggest using italic lettering to emphasize whether the direction of the question is negatively stated in an effort to combat biased response sets by the respondents. Some demographic information was collected along with other data using six opened-ended questions (See Appendix E).

Data Analysis

SPSS version 18.0 was used for the analysis of the data collected for this study. First, a descriptive analysis was conducted on the demographic items (gender, age, education, race, direct reports, and titles) (Table 2). The purpose of the descriptive analysis was to check for outliers, missing data, or any other noticeable abnormality that might possibly bias data analysis. Descriptive statistics (means and standard deviations) were conducted for each survey item and are illustrated in (Table 3).

Second, a bivariate correlation coefficient of the survey item responses was examined for any values greater than 0.9, which would indicate singularity of the data and a high correlation. Highly correlated items (greater than 0.9) would indicate that the items do not solicit enough response variation for proper analysis. The preferred score for proper analysis should be within the recommended value of 0.3 to 0.7 (Cohen, 1988).

Third, a varimax rotated factor analysis was done on the 30 scaled items to derive the component matrix which provided factor loadings. The data from the component

matrix was used to group the items according to how much they load on each factor. The component matrix was the central output of the factor analysis. The factor loadings or component loadings in Principal Component Analysis (PCA) are the correlation coefficients between the variables (rows) and factors (columns). Factor loadings were the basis for imputing a substantive label to the different factors. Loadings above 0.6 were considered high and those below 0 .4 low (Cohen, 1988). Therefore a high loading corresponded to the factor and a low did not. Items that group together tend to exhibit high loading on the same factor and we can conclude that they are measuring or tapping the same construct.

The factors with eigenvalues greater than or equal to 1.0 were considered relevant. The items were then compared and examined according to their factor loading, to determine what latent construct they most represented. In addition, a table was designed illustrating what items loaded on which factors according to their loading values. Also included was the communality for each factor (Table 4).

A reliability analysis was performed for each set of items representing the three latent factors. This provided the Cronbach alphas associated with each factor. Additionally, an item-by-item analysis was conducted in which the item statistics were used to determine if the coefficient alpha could be improved by removing any of the individual items.

Reliability was furthered verified by the communality measurement, which assessed the percent of variance in a given variable explained by all the factors jointly and interpreted as the reliability of the indicator. In general, communalities show for which measured variables the factor analysis is working best and least well.

Descriptive statistics for the three perception scale factors were performed and are listed in Table 5. The alpha coefficients for the three factors showed high correlation within each set of items. Thirteen items identified with preference, eleven with usefulness, and six with self-efficacy.

The study survey using similar methods of analysis as the pilot survey but with a 6 point scale was intended to measure the respondents' perception as positive or negative on the use of the interactive application MOODLE for competency testing, as compared to the traditional methods of testing. The analysis provides insight on the respondents' perception about the ease and effectiveness of MOODLE. The analysis looked at item means, standard deviations, and how the items loaded on each dimension after factor analysis. The statistical analysis showed whether the respondent had a positive perception of using the interactive application MOODLE or not. A high score on an item indicated that the respondent had a positive perception of MOODLE.

Open-Ended Questions

Analyzing of open-ended questions starts first by looking at the responses for evidences of themes that were predicted would be gathered by the questions themselves. Second, coding is performed by either of two method; instrumental or representational. The first method of coding is performed from the subjective point of view of the investigator coding the questions themselves and then using computer programs. In the second method the point of view of the participants is recognized and the computer is used as the management of information tool. However, the coding itself is performed by the investigator. The choice of method depends on the study and what the investigator is looking for (Geer, 1988). In this case it is the perception of the participants as it relates to

the three multidimensions selected after the performance of factor analysis on items 1 through 30; preference, usefulness, and self-efficacy.

The questions for this survey were stated in a way to solicit short answers relative to the participants' perceptions in using MOODLE. The questions were intended to collect opinions, nuances, rather than merely selecting answer to predetermined set of response like in questions 1 through 30. The open-ended questions were intended to contribute or augment questions 1 through 30 by accessing the participants' true perception of using MOODLE. The questions were intended to be more objective and not leading as in the closed-ended questions 1 through 30.

The open-ended questions responses were intended to solicit answers about how, what, when, where, and why. Open-ended questions have a great diversity of responses depending on the participants and that was certainly true with this survey. The answers to the open-ended questions in this survey varied for very short or none to complete sentences. An additional benefit of open-ended questions is that it cuts down on response error. Participants are less likely to forget the answers they have to choose from if they are given the chance to respond freely.

The techniques I used for this study in looking for patterns and trends are listed below:

1. I read through the responses looking for common themes.
2. I developed agreement and disagreement categories for the different themes selected.
3. I labeled each comment with one or several categories.
4. I looked at what I had and checked for trends.

5. I identified the patterns and trends.

Limitations

The study had several inherent limitations. Using MOODLE within a Personal Interactive Information Management Site is unique and especially designed for this study. Furthermore, there are no similar studies available to compare or evaluate. Moreover, the study population was a convenient sample selected from a specific population of clinical laboratory workers and not random. All of the individuals invited to participate in the study had to have completed competency testing using the interactive application MOODLE integrated with PIIMS. This prerequisite further limited the number of eligible participants. Because the sample was limited to one health organization, the results may not be readily generalizable. However, sampling laboratory personnel from several departments and outside labs within the same health institution provides support for use of competency testing using MOODLE in similar health institutions with the same type of organization. Moreover, the study provided valuable insight and information for future investigations on using interactive application such as MOODLE within PIIMS for competency testing in the clinical laboratories and other professions.

The minimum amount of data for factor analysis was only partially met. Due to practical and limited resources, 70 participants met the prerequisites and only 55 responded to the survey. The fact that a pilot survey and its data were used to develop the items for this survey, hopefully, compensated for the limited number of participants and data. The factor analysis of the major components indicates that it did. This is the first study of its kind and for practical reasons was limited in scope. Hopefully, in the future a more extensive research study can be conducted with more participants and resources.

Chapter Summary

This chapter described the method of analysis of the data for this study, purpose of the study, the research design, and statistical methods used. Also, included in the discussion was a description of the survey, sample population, the research procedures and limitations.

Chapter IV

Results

Introduction

The purpose of the study was to gather data on the perceptions of clinical laboratory personnel on the use of MOODLE for competency testing in a clinical laboratory. The factor analysis of the data showed evidence of three sub factors for perception: preference, usefulness, and self-efficacy.

Quantitative and qualitative data are discussed in this chapter. Questions 1 through 6, solicited data on demographics. Likert scaled questions were used for items 7 through 30; these questions solicited data on perception. The last 6 questions, 31 through 36, were open-ended questions which solicited objective responses.

Participants' Demographics

Data were collected from 55 of 70 clinical laboratory personnel who were invited to participate in the survey; the participation rate was 79%. Of the 70 participants invited to take the survey, 5 were lost due to attrition, and 10 did not participate. The initial 70 clinical personnel invited to take the survey were selected on the prerequisite of having recently used MOODLE for competency testing in the clinical laboratory. The sample group for the study consisted of clinical laboratory personnel that represent a larger population working in the Texas Medical Center in Houston, Texas. Furthermore, the different types of subgroups represented by the clinical laboratory personnel in the sample group are proportional to similar health institutions. The analysis of data listed in this chapter was performed using SPSS version 18.0

The demographic variables collected from the sample group provide insight on the characteristics of the population of clinical laboratory personnel. The clinical laboratory personnel were 73% female and representative of the U.S. population with regard to ethnic or racial background. Current population survey data show that the median age of clinical laboratory workers is 41 years (Grumbach, et al., 2002). The education level was a 4 year degree (67%), which compares to the number of technologists (55%) who hold 4 year degrees in the population sample. The majority of the participants did not supervise other employees (76%).

Table 2.

Demographics of Participants

Characteristics	Answer Option	Frequencies
Sex	Female	40
	Male	15
Age	22-25	1
	26-30	2
	30-40	5
	41-50	6
	51-60	35
	61-Over	6
Educational Level	High School-GED	2
	Some College	3
	2 Year Degree	7
	4 Year Degree	37
	Master's Degree	2
	Doctoral Degree	4
Race	White	18
	White, non-Hispanic	2
	African-American	12
	Hispanic	3
	Asian-Pacific Islander	20
People Supervised	None	42
	1-5	4
	6-10	3
	11-20	5
	31-40	1
Work Title	Supervisor	7
	Technologist	30
	Senior Tech	5
	Technician	3
	LLT-1	2
	LLT-2	7
	Senior LTT	1

One of the main causes of the current medical laboratory personnel shortage is the aging workforce. As the data indicated, the majority of the participants (64%) in this study were between 51 and 60 years old. Our nation's clinical laboratories are faced with a critically growing shortage of qualified laboratory personnel. This shortage hinders the clinical laboratory personnel's ability to meet the demands of a timely response to clinical laboratory tests. The vast majority of all medical diagnoses are based on laboratory test results. Unfortunately, the United States is facing a severe and increasingly problematic shortage of laboratory personnel, raising questions about whether America's medical laboratories have the personnel needed to handle today's and tomorrow's demand for medical laboratory testing services.

For the last ten or more years, training of new laboratory practitioners has consistently been unable to meet the demand for their services. There is steady and critical decline in the number of students graduating from medical laboratory training programs. According to a 2003 study by the American Society for Clinical Pathology, rural areas and areas served by smaller hospitals, are finding it difficult to recruit and retain clinical laboratory personnel. Half of all laboratories in the nation are reporting problems hiring laboratory personnel, and laboratories reported even greater difficulty finding laboratory personnel for the evening and night shifts. Personally, in my current position as laboratory manager in one of the major hospitals in the Houston area, it has been difficult to fill two open positions for medical technologists in the evening and night shift which have been posted for over five months. The American Society for Clinical Pathology (Strauss, 2009) states mechanisms are needed for the development and enhancement of laboratory training programs.

Using MOODLE linked to PIIMS is a viable solution for supporting the education and training of other allied health professionals who can substitute for laboratory personnel in performing moderately complex testing. This would be a workable solution for smaller clinical laboratories and would meet the federal rules and regulations of CLIA 1988 which apply to the operation of clinical laboratories. This will help alleviate the critical and growing shortage of medical laboratory personnel and make the operation of smaller labs in emergency center and rural hospitals more efficient and effective. Currently, working as a laboratory consultant, I am able to use MOODLE and PIIMS to provide training and competency testing for allied health workers in three emergency centers located throughout the Houston metropolitan area. I set up the training and competency testing for nurses and other allied health professional online so they can work in the clinical laboratories in the three emergency centers located throughout the Houston metropolitan area. The nurses and other allied health professional are required by federal law to only work in the facility they are trained in and only under the supervision of the medical director. They are **not** meant to replace the medical technologist; they are only there to fill in the gaps due to the shortage of qualified medical technologists.

Data Screening

In addition to the examination of demographic data, the descriptive results (means and standard deviations) of the survey responses were examined. Questions 4, 5, 6, 13, 19, and 22 were reverse coded for factor analysis since they were negatively stated.

Table 3.

Summary of Items Means and Standard Deviations: Strongly Agree (6) and Strongly Disagree (1).

Item	Mean	SD
Q1 MOODLE with PIIMS provides control over information and applications.	5.02	1.03
Q2 I would like to use an online interactive website to deliver testing and information.	5.00	1.02
Q3 MOODLE within PIIMS will allow for the creation and management of file.	5.07	0.94
Q4 I am *not* comfortable using an interactive site.	4.62*	1.31
Q5 I would rate the site as *hard* to navigate.	4.13*	1.48
Q6 I *hesitate* using a computer.	4.90*	1.30
Q7 Using an interactive site would make me more productive.	4.79	1.31
Q8 I don't feel apprehensive about using a computer or the internet.	4.67	1.52
Q9 I would rate MOODLE within PIIMS an effective tool for educational instruction and online testing.	5.02	0.99
Q10 I am capable of adding and deleting information to a database file.	4.11	1.47
Q11 I prefer using a computer for information management.	5.04	1.02
Q12 MOODLE will endow the participants with computer literacy skills that improve personal productivity.	5.04	1.02

Q13 Using computers make me feel *uncomfortable*.	4.73*	1.34
Q14 MOODLE and PIIMS are good sources for setting up an interactive website for educational instruction and competency testing.	5.00	1.09
Q15 I am capable of describing the three stages of data processing: input, processing and output.	4.44	1.29
Q16 I believe that educational instruction and competency testing in the clinical laboratory has *not* changed much in the last ten years.	3.91	1.54
Q17 Using a computer does not scare me at all.	5.27	0.97
Q18 I prefer using online computer competency testing over current methods of testing.	5.16	1.01
Q19 I find it *difficult* to use a computer for organizing information.	4.66*	1.14
Q20 I would rate the overall design of this Interactive website as excellent.	4.73	1.21
Q21 I am able to easily access the internet.	4.93	1.22
Q22 Having access to technical information online is *not* helpful.	4.85*	1.21
Q23 I would like to use an interactive site for a customized survey.	4.91	0.89
Q24 I would like an interactive site that provides control of information.	4.87	1.09
Q25 I would like to use a personal database for the collection and management of information.	4.85	1.13
Q26 I prefer to use an interactive site as a central location for my information.	4.84	1.10
Q27 I would like to be able to easily retrieve information from my personal database with an internet capable device.	5.16	0.98

Q28	I would like to create online tests using commonly available programs that require minimal or no computer programming skills such as MOODLE.	4.85	1.23
Q29	I would rate MOODLE and PIIMS as a viable choice for developing new interactive methods of educational instruction and competency testing.	5.07	0.96
Q30	I would rate the information on MOODLE and PIIMS as well organized.	5.05	1.03

Note: * Indicates negatively stated items which were reverse coded for factor analysis.

Factor Analysis

The Pearson correlation coefficient for the set of paired questions for each factor selected (preference, usefulness, and self-efficacy) indicated that the majority of items correlated fairly well. The set of items used for each selected factor were within the recommended value of 0.3 to 0.7 (Cohen, 1988) so there was no need to eliminate any items.

A principle components analysis was performed to explore any coherent factor structure that underlies the items in the survey. The component matrix gave the factor loading and was the central output for factor analysis. Factor loading was the basis for imputing the label to the different factors. The rotated factor matrix analyses yield six factors with eigenvalues greater than 1.0 (ranging from 1.15 to 12.78). These six factors accounted for 76% of the overall variance. After examining the factor loading of the six factors the first three factors with the highest number of items loading above 0.4 were used. Only the first three factors were used because they had the items evenly spread and appeared to cover the majority of coherent factor structure underlying the survey. The three factor solution, which explained 62% of the variance, was chosen for the reason that the last three factors lacked sufficient numbers of strong primary loading and were

difficult to interpret as unique factors. Only three items had strong primary loading on the last three factors (4, 5, and 6). Furthermore, the items loading on factor 4 through 6 appear to relate to the same themes as factor 1 through 3. Upon rotated factor analysis on just the first three factors, the three items (10, 16, & 21) each representing one of the reminding factors (4, 5, & 6), loaded above 0.4 on factor 1 and 2. Loading above 0.6 are usually considered high and those below 0.4 are low (Cohen, 1988).

Based on the theme related to each item and their strong primary loading, three latent factors or dimensions were named for the main construct of perception. The three latent factors named are preference, usefulness, and self-efficacy. Preference had the highest number of primary loading items, followed by usefulness and self-efficacy.

Multidimensional constructs are pervasive in research. A construct has multiple dimensions when it refers to several but distinct dimensions. An example of a multidimensional construct is a broad personality trait defined in terms of specific personality dimensions (McCrae & Costa, 1992). The use of multidimensional constructs has generated considerable debate. Supporters argue that it provides an overview of a complex phenomenon which allows us to match predictors with outcomes and also increases explained variance (Hanisch, Hulin, & Roznowski, 1998). The debate presents a dilemma for researchers who want the extensiveness and completeness of multidimensional constructs along with the simplicity and exactness of the dimensions that constitute the construct. These apparently conflicting objectives cannot be achieved if a researcher adopts only one side of the debate. Criticisms underlying the debate are often characterized as necessary, but many are just a matter of empirical assessment. For instance, you can statistically compare the variance explained by a construct to the one

explained by its multidimensional constructs. Similarly, the information provided by a single relationship between the construct and another variable can be compared to that provided by multiple relationships involving the dimensions of the construct (Edwards, 2000).

Table 4.

Summary of Items (N=30) and Factor Loading Based on a Principle Components Analysis with Varimax Rotation.

	Item	Factor Loading 1	2	3	Communality
Q24	I would like an interactive site that provides control of information.	**.87**	.20	.10	.81
Q25	I would like to use a personal database for the collection and management of information.	**.82**	.28	.13	.77
Q15	I am capable of describing the three stages of data processing: input, processing and output.	**.80**	.01	.04	.65
Q27	I would like to be able to easily retrieve information from my personal database with an internet capable device.	**.76**	.19	.38	.76
Q2	I would like to use an online interactive website to deliver testing and information.	**.76**	.16	.09	.61
Q11	I prefer using a computer for information management.	**.75**	.14	.26	.65
Q1	MOODLE with PIIMS provides control over information and applications.	**.74**	.28	-.21	.66
Q18	I prefer using online computer competency testing over current methods of testing	**.69**	.31	.27	.64
Q28	I would like to create online tests using commonly available programs that require minimal or no computer programming skills such as MOODLE.	**.68**	.25	.11	.53
Q21	I am able to easily access the internet.	**.65**	.22	.13	.49
Q26	I prefer to use an interactive site as a central location for my information.	**.64**	.45	.12	.63

Q3	MOODLE within PIIMS will allow for the creation and management of files.	**.58**	.47	-.19	.60
Q23	I would like to use an interactive site for a customized survey.	**.57**	.55	.15	.66
Q7	Using an interactive site would make me more productive.	**.**22	.**82**	.10	.72
Q12	MOODLE will endow the participants with computer literacy skills that improve personal productivity.	.37	**.79**	.17	.80
Q14	MOODLE and PIIMS are good sources for setting up an interactive website for educational instruction and competency testing.	.50	**.74**	.07	.80
Q29	I would rate MOODLE and PIIMS as a viable choice for developing new interactive methods of education instruction and competency testing.	.48	**.72**	.13	.76
Q30	I would rate the information on MOODLE and PIIMS as well organized.	.45	**.70**	-.02	.70
Q20	I would rate the overall design of this interactive website as excellent.	.49	**.69**	-.09	.73
Q5	I would rate the site as *hard* to navigate.	.06	**.64**	.30	.50
Q9	I would rate MOODLE within PIIMS an effective tool for educational instruction and online testing.	.58	**.60**	.05	.70
Q8	I don't feel apprehensive about using a computer or the internet.	-.11	**.50**	.12	.27
Q16	I believe that educational instruction and competency testing in the clinical laboratory has *not* changed much in the last ten years.	.16	**.48**	-.15	.28
Q10	I am capable of adding and deleting Information to a database file.	.15	**.43**	.04	.21
Q6	I *hesitate* using a computer.	.18	-.08	**.91**	.87

Q22	Having access to technical information online is *not* helpful.	-.17	.39	**.71**	.69
Q4	I am *not* comfortable using an interactive site.	-.01	.16	**.71**	.52
Q19	I find it *difficult* to use a computer for organizing information.	.20	.07	**.70**	.53
Q13	Using computers make me feel *uncomfortable*.	.22	-.11	**.69**	.54
Q17	Using a computer does not scare me at all.	.48	.17	**.52**	.53

Note: Boldface indicates highest factor loadings.

Three multidimensions or factors were extracted from the participants' perception; (a) preference, (b) usefulness, and (c) self-efficacy. The alpha coefficients for the three latent factors indicate high internal consistency: (preference: $\alpha = .94$); (usefulness: $\alpha = .88$); (self efficacy: $\alpha = .83$). Skewness and Kurtosis values are within +/- 1 and considered acceptable for statistical analysis.

Preference is a latent construct that included 13 items which identified with the preference of using an interactive application for online competency testing. The eigenvalue for the three latent constructs selected was over 1.0 for each one with preference having the highest at 12.78.

Usefulness is a latent construct that included 11 items which identified with the perception of the usefulness of interactive application. The eigenvalue for usefulness was the second highest at 3.24. This latent construct identified response patterns among the participants on items related to using an interactive application for creating and managing interactive applications and information.

Self-efficacy is the third and final latent construct that was selected and derived through factor analysis. It showed consistency among 6 items with an eigenvalue of 2.56. The responses by the participants to these items indicated proficiency in using computers, applications, and navigating the internet.

Table 5.

Descriptive Statistics Perception Scale Factors

Factors	Items	M(SD)	Skewness	Kurtosis	Alpha
Preference	13	4.93(1.09)	-.64	-.14	.94
Usefulness	11	4.68(1.32)	-.79	.16	.88
Self-efficacy	6	4.75(1.26)	-.69	-.20	.83

The exploratory factor analysis provided evidence of validity which was further confirmed by conducting a validity alignment check as discussed by Cox and Cox (2008). A table was designed in which the dimensions occupy the first column and the questionnaire items are shown in the first row. Each item's loading value was evaluated and checked against the guiding dimension each item was intended to refer to.

Table 6.

Sample Alignment Check

Factors	**Items**												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Preference	Q 1	Q2	Q3	Q11	Q15	Q18	Q21	Q23	Q24	Q25	Q26	Q27	Q28
Usefulness	Q5	Q7	Q8	Q9	Q10	Q12	Q14	Q16	Q20	Q29	Q30		
Self-efficacy	Q4	Q6	Q13	Q17	Q19	Q22							

Open-Ended Questions Results

There were six open-ended questions on the survey:

1. Describe what you like the most about the MOODLE site.
2. Describe what you like the least about the MOODLE site.
3. Please describe what you would like to see improved on the interactive website.
4. If the site were to include FAQ's, applications what questions would you ask?
5. Would you recommend the use of this or a similar interactive site for online testing and information management?
6. Would you recommend this website to a colleague seeking information on interactive websites for competency testing?

The main themes observed from the open-ended responses indicated the following themes: convenience, user friendliness, quality of digital images, login password, instructions, advance organizers, and more information on MOODLE.

Table 7.

Participants Responses to Open-Ended Questions:

Question	Common Themes	Frequencies
31. Describe what you like most about the MOODLE site.	Convenience	12
	User friendly	17
32. Describe what you like the least about the MOODLE site.	Digital images	10
	Log-in	8
	Lack of instructions	5
33. Please describe what you would like to see improved on the interactive website.	Advance organizers	2
	More information	5
	Login	6
	Digital images	11
34. If the site were to include FAQ's, applications what questions would you ask?	Info on inactive site	4
	More learning lessons	7
	How to set-up MOODLE	5
35. Would you recommend the use of this or a similar interactive site for online testing and information management?	Yes	48
	Easy grading	5
	Start and stop convenience	7
	Paperless method	2
36. Would you recommend this website to a colleague seeking information on interactive websites for competency testing?	Yes	46
	Educational	8
	Effective	7

The feedback provided by respondents on the open-ended questions about the capabilities of MOODLE and the interactive applications were positive overall. Some advantages mentioned were the convenience and effectiveness of MOODLE for competency testing. The major areas of agreement were on convenience, accessibility, and the ability to start and stop the testing. The following comments from the respondent demonstrate these points: "I find the use of MOODLE for competency testing very efficient and effective," "Easy to access and easy to use," "Readily available when I have time to use it," and "Like the ability to add, delete, and change things as needed."

Major disagreement or suggestion for improvement was in the quality of the digital pictures, focusing capabilities, login, and lack of more instructions on navigating the application. The following comments from the respondents demonstrate these points: "Hard to focus on pictures," "Quality of pictures is poor," "Log in password is not easy to use," and "Log in is tricky."

Chapter Summary

Data and results were presented in the preceding section. First, the demographics of the sample population were evaluated for overall characteristics. Second, descriptive data and results were reviewed for abnormalities that would affect the factor analysis. Third, a factor analysis was conducted on the all the data. Lastly, the description of the data illustrated the present of three sub factors: preference, usefulness, and self-efficacy.

Chapter V

Discussion

Introduction

This descriptive study used a 36-item computer-based survey to gather information on the perception of clinical laboratory personnel on the use of an interactive application within a Personal Interactive Information Management Site (PIIMS) (Perez, 2011). Factor analysis of the responses revealed three latent factors labeled preference, usefulness, and self-efficacy.

This chapter focuses on the conclusions and interpretations of the findings of the study. Implications and recommendations are also provided.

Conclusions

Competency and maturity in dealing with new computer technology and applications are increasing on a daily basis (Sam, Othman, & Nordin, 2005). New technologies and applications such as mobile devices and MOODLE make the interactivity of applications and information much easier to navigate. In addition, the advancement of social media and information sites such as Google and Wikipedia makes the accessibility and collaboration of information more accessible to the general population. New performance applications are becoming increasingly interactive and are used to solve a multitude of issues.

Innovation of new types of mobile devices and applications makes it important that we manage information more effectively and efficiently in order to support our personal and professional goals. The increase of these applications and information is becoming difficult to manage. Web 1.0 was a static depository for information but Web

2.0 has interactive capabilities for solving problems by means of using this interactive applications and information.

At the TechNet Summit in November 2006, Jerry Yang, founder and Chief Executive Officer of Yahoo, stated: "Web 2.0 is well documented and talked about. The power of the Net reached a critical mass, with capabilities that can be done on a network level. We are also seeing richer devices over last four years and richer ways of interacting with the network, not only in hardware like game consoles and mobile devices, but also in the software layer. You don't have to be a computer scientist to create a program. We are seeing that manifest in Web 2.0 and 3.0 will be a great extension of that, a true communal medium…the distinction between professional, semi-professional and consumers will get blurred, creating a network effect of business and applications" (Farber, 2006).

Information management by way of centralizing our information on PIIMS and using interactive applications such as MOODLE permits us to understand how they fit together and affect our lives. The consolidation of information and applications in one central location also decreases the level of complexity in managing our applications and information by making the process consistent and more manageable. A central network location for the management of interactive applications and information is truly a communal medium that can be used by the average person to connect and interact with the Net without the need or skills of a computer scientist.

At the Seoul Digital Forum in May 2007, Eric Schmidt, CEO of Google, was asked to define Web 2.0 and Web 3.0. He responded, "Web 2.0 is a marketing term, and I think you've just invented Web 3.0. But if I were to guess what Web 3.0 is, I would tell

you that it's a different way of building applications… My prediction would be that Web 3.0 will ultimately be seen as applications which are pieced together. There are a number of characteristics: the applications are relatively small, the data is in the cloud, the applications can run on any device, PC or mobile phone, the applications are very fast and they're very customizable. Furthermore, the applications are distributed virally: literally by social networks, by email. You won't go to the store and purchase them… That's a very different application model than we've ever seen in computing" (MacManus, 2007).

This study evaluated the actual practical use of an interactive application within a central network location for competency testing. I began work on the interactive site in 2010, and since then two organizations, the College of American Pathology and Siemens have designed and marketed similar interactive applications launched on their corporate sites. The difference between their interactive application and the one used for this study is that MOODLE is free and can be launched from a personal interactive site. The site serves as a virtual desktop on any internet mobile devices and can easily be redesigned from any computer.

The idea of designing and developing an interactive site such as PIIMS as a central network location and then incorporating other interactive applications such as MOODLE has great potential in different professional fields. The fact that it is versatile depending on the available interactive applications and devices makes it ideal for a variety of updatable uses. This study demonstrated that an interactive application such as MOODLE used within PIIMS can be used for the common function of delivering online competency testing and instruction.

The design and development of the interactive site PIIMS and consequently the incorporation of MOODLE did not require developing any new application but the innovative use of ubiquitous applications. The only new idea was how to design and develop a new innovative way of using the applications. New programs such as ColdFusion used for scripting language will eventually make the design and development of interactive websites as easy as setting up a static website. As interactive applications improve, the average person will eventually be able to set up an interactive site without the assistance of a computer programmer similarly to how static websites are designed without the assistance of website designers.

Investigating the online learning environments created by new information and applications is somewhat difficult without first understanding the elements effecting such an environment. The three main areas of new learning environments are technology changes, social changes, and lifestyle changes. Kaye and Medoff (2001) explained these components as cognitive change, emotional change, and behavioral change. It is clear that instructional technology and interactive applications can be investigated by evaluating these and associated elements.

The present study advances the understanding of using interactive applications like MOODLE for clinical laboratory competency testing. First, the findings provide evidence that the participants in this study had a positive perception on using MOODLE for competency testing. Second, the findings provide evidence through an exploratory factor analysis that the primary construct was multidimensional. Third, the findings of open-ended responses questions agree with the data derived from the study survey items

1 thru 30. The themes of the open-ended questions also indicate a positive view of using an interactive site such as MOODLE with PIIMS for competency testing.

Open-Ended Questions Discussion

Two main areas identified as problems were the images used on the MOODLE website and logging in to MOODLE. Part of the problems with the quality of the digital images could have been due to the lack of instructions on how to zoom in and out of images. For future development higher resolution digital images should be used and specific instructions given to participants on different methods for zooming in and out of images. It is important for laboratory technologists to be able to focus on specific parts of blood and urine sediment images. Technologist need to identify and distinguish small cellular inclusion illustrated in these digital images for analytical purposes.

The login problem can be addressed by providing pictures and instruction on how to login. MOODLE requires a different password format then just the work badge number which the participants are used to. For high security, MOODLE requires that the password contain lowercase letters, uppercase letters, numbers, and a symbol. I had assigned passwords which included the badge number, adding to the confusion. It is recommended that in future developments the person's capitalize first name with a unique number and symbol be used. This would avoid any confusion with using the badge number.

Some of the other areas of concern can be address by providing more information on competency testing using MOODLE. The use of introductory video instruction is also recommended. Introductory videos are readily available on YouTube and can easily be downloaded. The use of MOODLE within PIIMS allows the instructor to use a large

number of functions including setting up advance organizers. Advance organizers are relevant and inclusive introductory material presented before the instruction or testing occurs (Driscoll, 2005). The creation of dynamic advance organizer pages that provides the user with information and materials to help him/her recall prior knowledge that will assist him/her on successfully completing the competency test would address some of the participants' concerns on information materials. There is also a plethora of materials and videos on the internet that provide information on using MOODLE, setting up MOODLE, logging in, how to navigate the application, and so on. This material can easily be incorporated into any MOODLE site.

The use of interactive applications such as MOODLE discussed throughout this paper suggests that they can play an important part in effective and efficient management of competency testing and information management. Analysis performed on survey data indicated that users showed a positive preference, usefulness, and self-efficacy in using interactive applications.

As discussed in this study the utilization of MOODLE with PIIMS has many practical applications. It is novel idea for managing information and applications in a central location for a variety of tasks. The idea of using a central network location like PIIMS linked to interactive applications like MOODLE has practical applications in many professional fields and in the real world as evidenced by this study.

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Appendix A

E-email to participants

Date: 11/15/2011

Dear Colleagues,

As you well know, competency testing and the management of the results is a difficult task to accomplish in a clinical laboratory. I am asking for your opinion on the matter by means of a survey at the following URL address: http://www.macjuan.com. Your opinion on the use of MOODLE within a Personal Interactive Information Management Site for online competency testing and information management is important and greatly appreciated. Your opinion will provide new insight and information on the use of the new instructional technologies for online competency testing in the clinical laboratory. No identifying information will be collected, so you will be completely anonymous. As a token of appreciation for your participation, you will receive 5 dollars or the equivalent in a McDonald's gift card. Also, the final results of the survey will be available to you. If you would like a copy of the final results please e-mail a mailing address to zjjp01@sleh.com or stop by my office.

Thank you for your participation.

Juan Jose Perez, M.Ed., MPH, MT (ASCP)
Manager Shift Operations
Pathology Department Rm. P120 SA
St. Luke's Episcopal Health System
P.0. Box 20269, MC 4-265
Houston, TX 77225-0269
832-355-2344 or 3274 (Tel)
832-355-6444 (Fax)

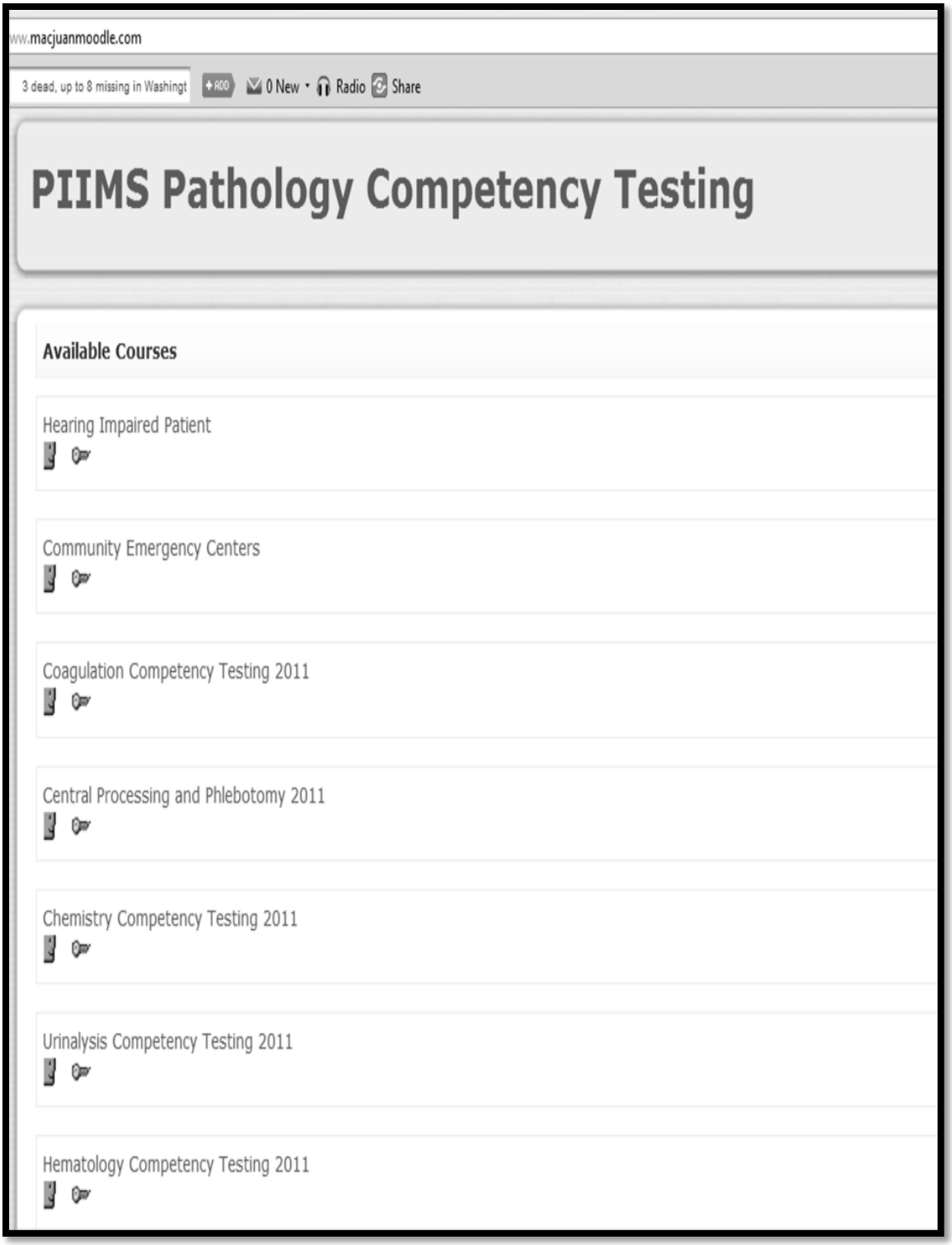
Appendix B

PIIMS


P.I.I.M.S
MacJuan.com
Personal Interactive Information Management Site
Home
About Us
Services
Contact Us
Comments
PIIMS
ONLINE APPLICATION
JUAN JOSE PEREZ
M.Ed., MPH, MT (ASCP)
Medical Laboratory Consultant
Ph. 832-814-2819
Juan@macjuan.com
http://www.macjuan.com
Announcement
MOODLE SURVEY ONLINE
MOODLE SURVEY MANUAL
Dissertation Defense
INTERACTIVE APPLICATIONS
Step by Step Instructions Creating an Interactive Website
moodle
Laboratory Competency Testing
neighbors
EMERGENCY CENTER
NOTHING IS SO ESSENTIAL IN A FREE GOVERNMENT AS THE GENERAL DIFFUSION OF KNOWLEDGE AND INTELLIGENCE OF EVERY KIND
EZERIEL W CULLEN
CLICK HERE FOR INTRODUCTION
What is PIIMS?
ANNOUNCEMENTS
CENTRAL NETWORK LOCATION
This Pages are Password Protected
1.
2. University of Houston
3. Video Conference Sites
4. Phone Conference
5. St. Luke's Hospital

Appendix C

MOODLE


www.macjuanmoodle.com
3 dead, up to 8 missing in Washingt
+ADD
0 New
Radio
Share
PIIMS Pathology Competency Testing
Available Courses
Hearing Impaired Patient
Community Emergency Centers
Coagulation Competency Testing 2011
Central Processing and Phlebotomy 2011
Chemistry Competency Testing 2011
Urinalysis Competency Testing 2011
Hematology Competency Testing 2011

Appendix D

Pilot Survey Instrument

Survey: Interactive Website for Information Management

First Name: Last Name:

Demographic Information		
1) Are you Male or Female? ○ Male ○ Female	2) What is your age? -- Select Here --	3) What is the highest level of education you have completed? -- Select Here --
4) What is your race? -- Select Here --	5) How many people do you supervise? -- Select Here --	

Please evaluate the following set of statements concerning the Interactive Website at http://www.macjuan.com/

Read each statement carefully and decide how much you agree or disagree with it and check the appropriate box.

There are no right or wrong answers. Only you can tell what you really believe.

Please answer all questions to post the survey.

Survey Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. I prefer using traditional methods of delivering educational instruction.	○	○	○	○	○
2. I am able to easily access the internet.	○	○	○	○	○
3. I am comfortable communicating electronically.	○	○	○	○	○
4. I am comfortable with written communication.	○	○	○	○	○
5. I am capable of describing the three stages of data processing: input, processing and output.	○	○	○	○	○
6. I am capable of explaining why a program (software) will or will not run on a particular computer.	○	○	○	○	○
7. When it comes to learning and studying I am self-directed person.	○	○	○	○	○
8. I have *difficulty* navigating an interactive website.	○	○	○	○	○
9. I am capable of learning advanced skills within a specific program or application.	○	○	○	○	○
10. I am capable of adding and deleting information to a database file.	○	○	○	○	○
11. I have trouble using the computer to organize or manipulate information.	○	○	○	○	○
12. I have *difficulty* using a user's guide when help is necessary.	○	○	○	○	○
13. I am capable of inserting and modifying figures, images and tables on the computer.	○	○	○	○	○
14. It is helpful having links embedded in an interactive website.	○	○	○	○	○
15. The site will provide the trainer with increase control over training activities.	○	○	○	○	○
16. It is helpful using external websites to augment the content of a website.	○	○	○	○	○
17. I *don't* see a need for having access to the internet at home.	○	○	○	○	○
18. It is helpful to have access to the internet at work.	○	○	○	○	○
19. I am able to manage my study time effectively and easily complete my					

assignments on time.	○	○	○	○	○
20. The interactive site will endow the participants with computer literacy skills that can result in improved personal productivity.	○	○	○	○	○
21. An interactive site would *not* reduces current resource requirement.	○	○	○	○	○
22. The site will *not* help train greater number of people on a given time.	○	○	○	○	○
23. The site will *not* reduce current resource requirements.	○	○	○	○	○
24. The site provides the trainer with increase control over the training activities.	○	○	○	○	○
25. Using an interactive site for information management *will* require additional equipment and resources.	○	○	○	○	○
26. The interactive site meets the need for round-the-clock training for a 24 hour operation.	○	○	○	○	○
27. The site allows for the creation and management of files.	○	○	○	○	○
28. I would rate the site as a good source of information on setting up an interactive website.	○	○	○	○	○
29. I would rate the site as a good source for managing information and record keeping.	○	○	○	○	○
30. I would rate the information on the interactive site as well organized.	○	○	○	○	○
31. I would rate the site as *hard* to navigate.	○	○	○	○	○
32. I would rate the site as easy to find and locate information.	○	○	○	○	○
33. I would rate the site as providing a better user experience in taking an on-line test.	○	○	○	○	○
34. I would rate the overall design of this interactive website as excellent.	○	○	○	○	○
35. I would rate the information found on this website as *inadequate*.	○	○	○	○	○
36. I would rate the website as an effective tool for facilitating on-line testing.	○	○	○	○	○
37. I would rate the site as a good link for continuing educational materials.	○	○	○	○	○
38. I would rate the site as an excellent choice for developing new interactive methods for instruction and testing.	○	○	○	○	○
39. I would rate the site as *difficult* to set up using the step-by-step directions.	○	○	○	○	○
40. I prefer on-line testing rather then paper and pencil testing.	○	○	○	○	○
41. I would like to see my teaching institution use modern instructional technology more.	○	○	○	○	○
42. I would like to use an on-line interactive website to deliver testing and information to better manage my time at work.	○	○	○	○	○
43. I would like to be able to have results of tests easily available for inspections.	○	○	○	○	○
44. I would be interested in accessing on-line testing via the internet at home.	○	○	○	○	○
45. I feel face-to-face contact with an instructor is necessary for learning to occur.	○	○	○	○	○
46. Having access to technical information on-line is *not* helpful.	○	○	○	○	○
47. Advance organizers that present materials before testing are *not* helpful.	○	○	○	○	○

Macjuan_Survey Page 3 of 3

48. On-line testing and posting solutions with answers on-line are *not* very helpful.	○	○	○	○	○
49. I would like to be able to track and collect information on a database.	○	○	○	○	○
50. I would like to be able to easily extract presentable information from a database.	○	○	○	○	○
51. I would like to be able to create tests using commonly available programs that require minimal computer programming skills.	○	○	○	○	○
52. I prefer on-line methods of delivering educational instruction and testing.	○	○	○	○	○

53. Describe what you like most about the interactive website.

54. Describe what you like the least about the interactive website.

55. Please describe what you would like to see improved on the interactive website

56. If the site were to include a Frequently Asked Questions section, what questions would you recommend be answered?

57. Would you recommend the use of this or a similar interactive site for on-line testing and information management? Why or why not?

58. Would you recommend this website to a colleague looking for information on interactive websites?

Submit

Appendix E

Survey Instrument

Survey: Perception on the use of Moodle for Online Competency Testing

Demographic Information		
1) Are you Male or Female? ○ Male ○ Female	2) What is your age? -- Select Here --	3) What is the highest level of education you have completed? -- Select Here --
4) What is your race? -- Select Here --	5) How many people do you supervise? -- Select Here --	6.) What is your title at work? -- Select Here --

Please evaluate the following set of statements concerning Moodle, which you used for competency testing located in PIIMS at http://www.macjuan.com/.

Read each statement carefully and decide how much you agree or disagree with it and check the appropriate box.

There are no right or wrong answers. Only you can tell what you really believe.

Survey	Strongly Agree	Slightly Agree	Agree	Disagree	Slightly Disagree	Strongly Disagree
1. Moodle within PIIMS provides the user with control over information and applications.	○	○	○	○	○	○
2. I would like to use Moodle an online interactive website to deliver testing and information.	○	○	○	○	○	○
3. Moodle within PIIMS will allow for the creation and management of files.	○	○	○	○	○	○
4. I am not comfortable using an interactive site.	○	○	○	○	○	○
5. I would rate the site as *hard* to navigate.	○	○	○	○	○	○
6. I hesitate using a computer.	○	○	○	○	○	○
7. Using an interactive site such as Moodle will make me more productive.	○	○	○	○	○	○
8. I don't feel apprehensive about using a computer.	○	○	○	○	○	○

9. I would rate Moodle within PIIMS as an effective tool for facilitating online testing.	○	○	○	○	○	○
10. I am capable of adding and deleting information to a database file.	○	○	○	○	○	○
11. I prefer using a computer for information management.	○	○	○	○	○	○
12. Moodle will endow the participants with computer literacy skills that improve personal productivity.	○	○	○	○	○	○
13. Using computers makes me feel *uncomfortable.*	○	○	○	○	○	○
14. Moodle and PIIMS are good sources for setting up an interactive website for competency testing.	○	○	○	○	○	○
15. I am capable of describing the three stages of data processing: input, processing and output.	○	○	○	○	○	○
Part II of Survey	Strongly Agree	Slightly Agree	Agree	Disagree	Slightly Disagree	Strongly Disagree
16. I believe that competency testing in the clinical laboratory has not changed much in the last ten years.	○	○	○	○	○	○
17. Using a computer does not scare me at all.	○	○	○	○	○	○
18. I prefer using Moodle online competency testing than the current traditional methods of testing.	○	○	○	○	○	○
19. I find it *difficult* to use a computer for organizing information.	○	○	○	○	○	○
20. I would rate the overall design of Moodle as excellent.	○	○	○	○	○	○
21. I am able to easily access the internet.	○	○	○	○	○	○
22. Having access to technical information online is *not* helpful.	○	○	○	○	○	○
23. I would like to use an interactive site such as Moodle within PIIMS for customized surveys.	○	○	○	○	○	○
24. I would like an interactive site that provides control of information and applications.	○	○	○	○	○	○
25. I would like to use a database for the collection of surveyed information.	○	○	○	○	○	○
26. I prefer to use an interactive site as a central location for all my information and applications.	○	○	○	○	○	○
27. I would like to be able to easily retrieve presentable information from a database.	○	○	○	○	○	○

28. I would like to be able to create online tests using commonly available programs that require minimal computer programming skills such as Moodle.	○	○	○	○	○	○
29. I would rate Moodle and PIIMS as a viable choice for developing new interactive methods of instruction and testing.	○	○	○	○	○	○
30. I would rate the information on Moodle and PIIMS as well organized.	○	○	○	○	○	○

31. Describe what you like most about the Moodle website.

32. Describe what you like the least about the Moodle website.

33. Please describe what you would like to see improved on the interactive website

34. If the site were to include a Frequently Asked Questions section, what questions would you ask?

35. Would you recommend the use of this or a similar interactive site for online testing and information management? Why or why not?

36. Would you recommend this website to a colleague looking for information on online interactive websites for competency testing?

Appendix F

Human Subject Approvals

UNIVERSITY of **HOUSTON**

DIVISION OF RESEARCH

January 19, 2012

Juan Perez
c/o Dr. Sara G. McNeil
Dean, Education

Dear Juan Perez,

Based upon your request for exempt status, an administrative review of your research proposal entitled "Perceptions on using MOODLE in a Clinical Laboratory" was conducted on December 14, 2011.

At that time, your request for exemption under **Category 1B** was approved pending modification of your proposed procedures/documents.

The changes you have made adequately respond to the identified contingencies. As long as you continue using procedures described in this project, you do not have to reapply for review. * Any modification of this approved protocol will require review and further approval. Please contact me to ascertain the appropriate mechanism.

If you have any questions, please contact Alicia Vargas at (713) 743-9215.

Sincerely yours,

Kirstin M. Rochford, MPH, CIP, CPIA
Director, Research Compliance

*Approvals for exempt protocols will be valid for 5 years beyond the approval date. Approval for this project will expire **December 1, 2016.** If the project is completed prior to this date, a final report should be filed to close the protocol. If the project will continue after this date, you will need to reapply for approval if you wish to avoid an interruption of your data collection.

Protocol Number: 12192-EX

316 E. Cullen Building Houston, TX 77204-2015 (713) 743-9204 Fax: (713) 743-9577
COMMITTEES FOR THE PROTECTION OF HUMAN SUBJECTS

Institutional Review Board
Telephone: 832-355-3347
Fax: 713-610-2272

November 21, 2011

Juan Jose Perez
Pathology Department
6720 Bertner Ave., MC 4-268
Houston, TX 77030

Project #3087
"The Measurement of Perceptions on the Use of Moodle Within a Personal Interactive Information Management Site for Online Competency Testing in a Clinical Laboratory"

Dear Mr. Perez:

Thank you for your response to the request by the St. Luke's Episcopal Hospital Institutional Review Board at their November 2, 2011 meeting. The committee has accepted your responses to the recommendations and I am pleased to inform you that the above referenced protocol is approved according to institutional guidelines. The IRB approval for this project will expire 12 months from the review date of November 2, 2011. IRB approval expires November 1, 2012. To avoid suspension of this study, IRB review must be completed at the October 3, 2012 meeting.

This letter will serve as verification that the St. Luke's Episcopal Hospital Institutional Review Board operates in accordance with all applicable laws, regulations and guidelines for clinical trials and under Federal Wide Assurance No. FWA00002312, issued April 8, 2002. We maintain compliance with the FDA Code of Federal Regulations, International Conference of Harmonization (ICH) and Good Clinical Practice (GCP) guidelines.

Continued review of the study will be required as follows:

a. Annually
b. Prior to any change in the protocol
c. Promptly after unanticipated problems (adverse events)
d. After any other unusual occurrence

The method of review will be by written summary.

Juan Jose Perez November 21, 2011
Page 2

The administrative review process of protocols is handled separately from the IRB review. When final administrative approval is granted, you will receive notification from the Department of Research. Should you have any questions regarding administrative approval, please contact Cheryl Fullmer at 832-355-6801.

Sincerely,

Arthur W. Bracey, M.D.
Chair
Institutional Review Board

AWB/are

Department of Research
Telephone: 832-355-3710
Fax: 713-610-2272

November 4, 2011

Juan Jose Perez
Pathology Department
6720 Bertner Ave., MC 4-268
Houston, TX 77030

Project #3087
"The Measurement of Perceptions on the Use of Moodle Within a Personal Interactive Information Management Site for Online Competency Testing in a Clinical Laboratory"

Dear Mr. Perez:

Please accept this letter as notification that your protocol has received administrative approval from the Department of Research at St. Luke's Episcopal Hospital. We are looking forward to working with you in support of your research efforts.

Since the data collection required for this study will not be charged to a patient account or to a contract account for sponsor reimbursement, no accounts will be opened for this study. If there are any amendments to your study that may affect patient care, please notify the Department of Research upon IRB approval and submit all documentation (investigator's brochure, informed consent, protocol, etc.) relevant to the amendment.

For any questions, I can be reached at 832-355-3710. Thank you.

Sincerely,

Cheryl P. Fullmer RN, MBA
Director, Clinical Research
St. Luke's Episcopal Hospital

cc: IRB File

Appendix G

SPSS Data

Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Q1	55	3	3	6	276	5.02	.139
Q2	55	4	2	6	275	5.00	.137
Q3	55	3	3	6	279	5.07	.127
Q4	55	5	1	6	131	2.38	.177
Q5	55	5	1	6	158	2.87	.199
Q6	55	4	1	5	115	2.09	.175
Q7	55	5	1	6	261	4.75	.176
Q8	55	5	1	6	257	4.67	.204
Q9	55	4	2	6	276	5.02	.134
Q10	55	5	1	6	226	4.11	.199
Q11	55	4	2	6	277	5.04	.137
Q12	55	4	2	6	277	5.04	.137
Q13	55	5	1	6	125	2.27	.161
Q14	55	4	2	6	275	5.00	.147
Q15	55	5	1	6	244	4.44	.174
Q16	55	5	1	6	215	3.91	.208
Q17	55	4	2	6	290	5.27	.131
Q18	55	4	2	6	284	5.16	.137
Q19	55	4	1	5	129	2.35	.154
Q20	55	4	2	6	260	4.73	.163
Q21	55	5	1	6	271	4.93	.164
Q22	55	4	1	5	118	2.15	.163
Q23	55	2	4	6	270	4.91	.120
Q24	55	4	2	6	268	4.87	.147
Q25	55	4	2	6	267	4.85	.152
Q26	55	5	1	6	266	4.84	.149
Q27	55	3	3	6	284	5.16	.132
Q28	55	5	1	6	267	4.85	.167
Q29	55	2	4	6	279	5.07	.129
Q30	55	4	2	6	278	5.05	.138
Valid N (listwise)	55						

	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Q1	1.027	1.055	-.250	.322	-1.652	.634
Q2	1.018	1.037	-.546	.322	-.480	.634
Q3	.940	.884	-.288	.322	-1.528	.634
Q4	1.312	1.722	.625	.322	-.226	.634
Q5	1.479	2.187	.334	.322	-.768	.634
Q6	1.295	1.677	.834	.322	-.405	.634
Q7	1.308	1.712	-1.051	.322	.944	.634
Q8	1.516	2.298	-1.170	.322	.774	.634
Q9	.991	.981	-.512	.322	-.449	.634
Q10	1.474	2.173	-.591	.322	-.139	.634
Q11	1.018	1.036	-.622	.322	-.386	.634
Q12	1.018	1.036	-.731	.322	-.138	.634
Q13	1.340	1.795	.724	.322	-.201	.634
Q14	1.089	1.185	-.536	.322	-.817	.634
Q15	1.288	1.658	-.394	.322	-.372	.634
Q16	1.543	2.380	-.125	.322	-.961	.634
Q17	.971	.943	-1.087	.322	.562	.634
Q18	1.014	1.028	-1.004	.322	.343	.634
Q19	1.142	1.304	.280	.322	-.744	.634
Q20	1.209	1.461	-.363	.322	-.973	.634
Q21	1.215	1.476	-1.078	.322	1.045	.634
Q22	1.208	1.460	.626	.322	-.489	.634
Q23	.888	.788	.183	.322	-1.730	.634
Q24	1.090	1.187	-.363	.322	-.908	.634
Q25	1.129	1.275	-.425	.322	-.949	.634
Q26	1.102	1.213	-.785	.322	.996	.634
Q27	.977	.954	-.588	.322	-1.189	.634
Q28	1.239	1.534	-.867	.322	.305	.634
Q29	.959	.921	-.149	.322	-1.943	.634
Q30	1.026	1.053	-.539	.322	-.660	.634
Valid N (listwise)						

Correlation Matrix

		Q1	Q2	Q3	Q7	Q8	Q9	Q10
Correlation	Q1	1.000	.726	.689	.472	-.008	.546	.035
	Q2	.726	1.000	.561	.278	.120	.624	.111
	Q3	.689	.561	1.000	.467	.160	.635	.181
	Q7	.472	.278	.467	1.000	.340	.561	.399
	Q8	-.008	.120	.160	.340	1.000	.214	.240
	Q9	.546	.624	.635	.561	.214	1.000	.252
	Q10	.035	.111	.181	.399	.240	.252	1.000
	Q11	.513	.608	.423	.410	.056	.550	.219
	Q12	.389	.375	.501	.716	.404	.697	.417
	Q14	.563	.568	.688	.702	.314	.841	.300
	Q15	.540	.537	.417	.221	-.115	.429	.394
	Q16	.398	.083	.298	.401	-.005	.134	.306
	Q17	.292	.449	.282	.289	.250	.341	.173
	Q18	.477	.610	.473	.381	.144	.716	.198
	Q20	.541	.451	.637	.588	.203	.716	.266
	Q21	.402	.464	.378	.244	.097	.509	.180
	Q23	.550	.512	.585	.681	.253	.718	.291
	Q24	.647	.718	.588	.419	.120	.620	.239
	Q25	.593	.532	.499	.438	-.039	.565	.321
	Q26	.575	.446	.477	.574	.167	.529	.376
	Q27	.458	.652	.410	.236	.137	.571	.257
	Q28	.468	.382	.423	.320	.063	.410	.344
	Q29	.562	.436	.610	.723	.259	.681	.230
	Q30	.526	.496	.495	.604	.309	.691	.167
	Rev_Q4	.005	.111	-.007	.277	.141	.091	.127
	Rev_Q5	.072	.148	.246	.419	.077	.453	.401
	Rev_Q6	-.054	.169	-.040	.041	.051	.102	-.043
	Rev_Q13	.031	.190	.001	.023	.001	.171	-.144
	Rev_Q19	.053	.223	.024	.225	-.067	.055	.177
	Rev_Q22	-.058	.090	-.007	.339	.246	.250	.103

Correlation Matrix

		Q11	Q12	Q14	Q15	Q16	Q17	Q18
Correlation	Q1	.513	.389	.563	.540	.398	.292	.477
	Q2	.608	.375	.568	.537	.083	.449	.610
	Q3	.423	.501	.688	.417	.298	.282	.473
	Q7	.410	.716	.702	.221	.401	.289	.381
	Q8	.056	.404	.314	-.115	-.005	.250	.144
	Q9	.550	.697	.841	.429	.134	.341	.716
	Q10	.219	.417	.300	.394	.306	.173	.198
	Q11	1.000	.446	.501	.539	.132	.515	.694
	Q12	.446	1.000	.719	.299	.415	.402	.532
	Q14	.501	.719	1.000	.396	.243	.473	.637
	Q15	.539	.299	.396	1.000	.197	.333	.497
	Q16	.132	.415	.243	.197	1.000	-.057	.104
	Q17	.515	.402	.473	.333	-.057	1.000	.556
	Q18	.694	.532	.637	.497	.104	.556	1.000
	Q20	.460	.746	.746	.280	.354	.364	.566
	Q21	.451	.451	.476	.482	.214	.378	.506
	Q23	.619	.598	.709	.457	.224	.395	.511
	Q24	.756	.539	.562	.661	.202	.454	.673
	Q25	.714	.569	.542	.681	.375	.459	.636
	Q26	.534	.650	.602	.626	.427	.354	.489
	Q27	.627	.571	.522	.678	.170	.616	.664
	Q28	.460	.416	.453	.644	.342	.372	.521
	Q29	.377	.794	.745	.364	.405	.475	.501
	Q30	.317	.725	.763	.318	.331	.394	.579
	Rev_Q4	.302	.149	.233	.122	.010	.330	.145
	Rev_Q5	.169	.526	.483	.097	.427	.156	.393
	Rev_Q6	.298	.157	.131	.180	-.115	.521	.350
	Rev_Q13	.211	.184	.063	.070	-.165	.371	.211
	Rev_Q19	.348	.250	.030	.167	.224	.404	.338
	Rev_Q22	.080	.321	.296	-.042	.042	.271	.186

Correlation Matrix

		Q20	Q21	Q23	Q24	Q25	Q26	Q27
Correlation	Q1	.541	.402	.550	.647	.593	.575	.458
	Q2	.451	.464	.512	.718	.532	.446	.652
	Q3	.637	.378	.585	.588	.499	.477	.410
	Q7	.588	.244	.681	.419	.438	.574	.236
	Q8	.203	.097	.253	.120	-.039	.167	.137
	Q9	.716	.509	.718	.620	.585	.529	.571
	Q10	.266	.180	.291	.239	.321	.376	.257
	Q11	.460	.451	.619	.756	.714	.534	.627
	Q12	.746	.451	.598	.539	.589	.650	.571
	Q14	.746	.476	.709	.562	.542	.602	.522
	Q15	.280	.482	.457	.661	.681	.626	.678
	Q16	.354	.214	.224	.202	.375	.427	.170
	Q17	.364	.378	.395	.454	.459	.354	.616
	Q18	.566	.506	.511	.673	.636	.489	.664
	Q20	1.000	.491	.598	.507	.622	.480	.493
	Q21	.491	1.000	.492	.594	.573	.434	.541
	Q23	.598	.492	1.000	.677	.670	.666	.487
	Q24	.507	.594	.677	1.000	.782	.677	.698
	Q25	.622	.573	.670	.782	1.000	.755	.744
	Q26	.480	.434	.666	.677	.755	1.000	.679
	Q27	.493	.541	.487	.698	.744	.679	1.000
	Q28	.455	.620	.476	.549	.726	.647	.694
	Q29	.688	.545	.682	.576	.574	.660	.540
	Q30	.774	.553	.575	.487	.519	.532	.490
	Rev_Q4	-.032	-.041	.367	.056	.174	.276	.194
	Rev_Q5	.496	.294	.305	.114	.355	.263	.306
	Rev_Q6	-.063	.266	.154	.254	.193	.158	.451
	Rev_Q13	.045	.443	.150	.255	.169	.120	.346
	Rev_Q19	.159	.102	.224	.291	.391	.219	.367
	Rev_Q22	.074	.018	.212	.000	-.002	.177	.303

Correlation Matrix

		Q28	Q29	Q30	Rev_Q4	Rev_Q5	Rev_Q6	Rev_Q13
Correlation	Q1	.468	.562	.526	.005	.072	-.054	.031
	Q2	.382	.436	.496	.111	.148	.169	.190
	Q3	.423	.610	.495	-.007	.246	-.040	.001
	Q7	.320	.723	.604	.277	.419	.041	.023
	Q8	.063	.259	.309	.141	.077	.051	.001
	Q9	.410	.681	.691	.091	.453	.102	.171
	Q10	.344	.230	.167	.127	.401	-.043	-.144
	Q11	.460	.377	.317	.302	.169	.298	.211
	Q12	.416	.794	.725	.149	.526	.157	.184
	Q14	.453	.745	.763	.233	.483	.131	.063
	Q15	.644	.364	.318	.122	.097	.180	.070
	Q16	.342	.405	.331	.010	.427	-.115	-.165
	Q17	.372	.475	.394	.330	.156	.521	.371
	Q18	.521	.501	.579	.145	.393	.350	.211
	Q20	.455	.688	.774	-.032	.496	-.063	.045
	Q21	.620	.545	.553	-.041	.294	.266	.443
	Q23	.476	.682	.575	.367	.305	.154	.150
	Q24	.549	.576	.487	.056	.114	.254	.255
	Q25	.726	.574	.519	.174	.355	.193	.169
	Q26	.647	.660	.532	.276	.263	.158	.120
	Q27	.694	.540	.490	.194	.306	.451	.346
	Q28	1.000	.477	.429	.102	.435	.211	.098
	Q29	.477	1.000	.805	.037	.424	.199	.261
	Q30	.429	.805	1.000	-.067	.435	.060	.132
	Rev_Q4	.102	.037	-.067	1.000	.274	.557	.256
	Rev_Q5	.435	.424	.435	.274	1.000	.248	.037
	Rev_Q6	.211	.199	.060	.557	.248	1.000	.722
	Rev_Q13	.098	.261	.132	.256	.037	.722	1.000
	Rev_Q19	.252	.243	.080	.466	.399	.617	.421
	Rev_Q22	.023	.313	.186	.560	.384	.560	.410

Correlation Matrix

		Rev_Q19	Rev_Q22
Correlation	Q1	.053	-.058
	Q2	.223	.090
	Q3	.024	-.007
	Q7	.225	.339
	Q8	-.067	.246
	Q9	.055	.250
	Q10	.177	.103
	Q11	.346	.080
	Q12	.250	.321
	Q14	.030	.296
	Q15	.167	-.042
	Q16	.224	.042
	Q17	.404	.271
	Q18	.338	.186
	Q20	.159	.074
	Q21	.102	.018
	Q23	.224	.212
	Q24	.291	.000
	Q25	.391	-.002
	Q26	.219	.177
	Q27	.367	.303
	Q28	.252	.023
	Q29	.243	.313
	Q30	.080	.186
	Rev_Q4	.466	.560
	Rev_Q5	.399	.384
	Rev_Q6	.617	.560
	Rev_Q13	.421	.410
	Rev_Q19	1.000	.352
	Rev_Q22	.352	1.000

Communalities

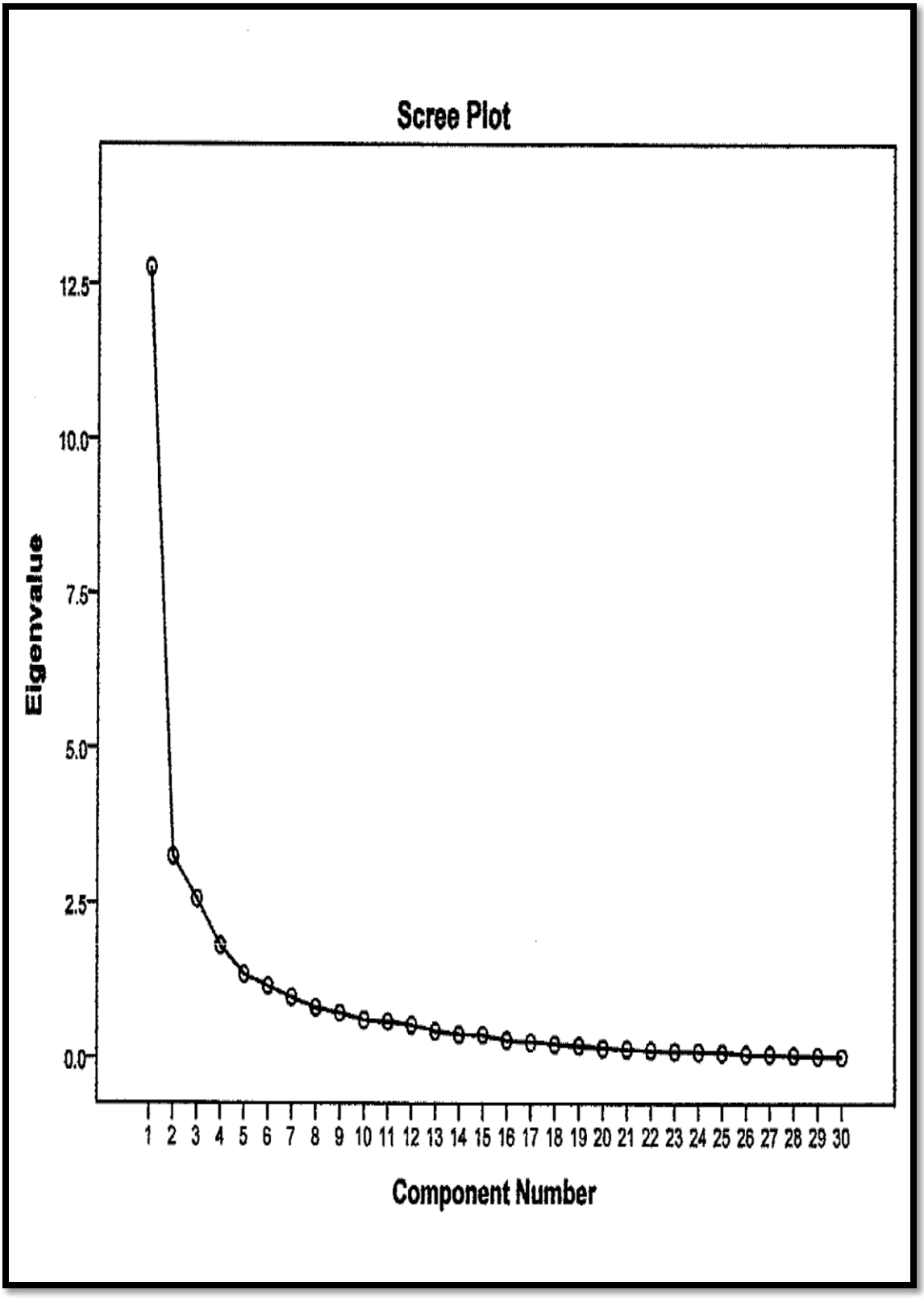
	Initial	Extraction
Q1	1.000	.835
Q2	1.000	.703
Q3	1.000	.664
Q7	1.000	.802
Q8	1.000	.679
Q9	1.000	.778
Q10	1.000	.759
Q11	1.000	.723
Q12	1.000	.817
Q14	1.000	.855
Q15	1.000	.772
Q16	1.000	.740
Q17	1.000	.615
Q18	1.000	.665
Q20	1.000	.775
Q21	1.000	.724
Q23	1.000	.746
Q24	1.000	.824
Q25	1.000	.855
Q26	1.000	.718
Q27	1.000	.815
Q28	1.000	.745
Q29	1.000	.824
Q30	1.000	.831
Rev_Q4	1.000	.824
Rev_Q5	1.000	.713
Rev_Q6	1.000	.886
Rev_Q13	1.000	.754
Rev_Q19	1.000	.717
Rev_Q22	1.000	.716

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.776	42.587	42.587	12.776	42.587	42.587
2	3.241	10.802	53.390	3.241	10.802	53.390
3	2.561	8.538	61.927	2.561	8.538	61.927
4	1.800	5.999	67.926	1.800	5.999	67.926
5	1.342	4.473	72.399	1.342	4.473	72.399
6	1.154	3.846	76.245	1.154	3.846	76.245
7	.973	3.244	79.489			
8	.804	2.679	82.168			
9	.719	2.396	84.564			
10	.606	2.019	86.584			
11	.578	1.925	88.509			
12	.526	1.753	90.262			
13	.426	1.419	91.682			
14	.370	1.234	92.916			
15	.363	1.210	94.125			
16	.279	.931	95.056			
17	.247	.825	95.881			
18	.215	.717	96.598			
19	.186	.619	97.217			
20	.152	.508	97.725			
21	.133	.445	98.170			
22	.113	.375	98.546			
23	.100	.332	98.877			
24	.091	.303	99.180			
25	.074	.246	99.426			
26	.054	.179	99.605			
27	.050	.167	99.772			
28	.034	.113	99.884			
29	.022	.073	99.958			
30	.013	.042	100.000			

Extraction Method: Principal Component Analysis.


Scree Plot
Eigenvalue
12.5
10.0
7.5
5.0
2.5
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Component Number

Component Matrix[a]

	Component					
	1	2	3	4	5	6
Q1	.690	-.332	-.279	-.080	.108	-.392
Q2	.700	-.022	-.344	-.251	.146	-.105
Q3	.687	-.349	-.038	-.152	.090	-.195
Q7	.678	-.137	.495	.043	.219	-.171
Q8	.241	-.001	.463	-.315	.275	.481
Q9	.815	-.154	.106	-.280	.011	.008
Q10	.379	-.083	.246	.512	.207	.492
Q11	.721	.146	-.326	.015	.272	-.040
Q12	.797	-.071	.398	-.013	-.092	.097
Q14	.837	-.163	.258	-.223	.105	-.001
Q15	.636	-.034	-.491	.289	.134	.153
Q16	.375	-.282	.246	.569	-.210	-.302
Q17	.591	.413	-.093	-.207	.072	.196
Q18	.774	.118	-.156	-.132	-.034	.096
Q20	.766	-.303	.207	-.099	-.197	-.038
Q21	.661	.011	-.226	-.089	-.429	.209
Q23	.804	-.048	.082	-.055	.274	-.111
Q24	.815	-.024	-.384	-.047	.100	.002
Q25	.832	-.020	-.285	.282	-.033	-.023
Q26	.789	-.057	-.042	.253	.159	.002
Q27	.791	.250	-.277	.047	-.073	.207
Q28	.694	-.018	-.224	.362	-.180	.222
Q29	.821	-.100	.266	-.127	-.202	-.108
Q30	.761	-.236	.248	-.241	-.278	.021
Rev_Q4	.244	.640	.234	.174	.483	-.191
Rev_Q5	.488	.116	.495	.344	-.314	.004
Rev_Q6	.300	.881	-.042	-.059	-.122	-.025
Rev_Q13	.261	.674	-.113	-.298	-.351	-.084
Rev_Q19	.352	.635	.032	.351	-.091	-.239
Rev_Q22	.268	.599	.511	-.095	.065	-.103

Extraction Method: Principal Component Analysis.

a. 6 components extracted.

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
Q1	.482	.646	-.178	-.312	.203	-.126
Q2	.373	.703	.077	-.214	-.133	-.023
Q3	.619	.476	-.167	-.127	.068	-.074
Q7	.759	.164	.088	.219	.153	-.346
Q8	.434	-.104	.051	.418	-.543	-.092
Q9	.750	.442	.067	.008	-.110	.051
Q10	.159	.230	-.049	.814	.096	-.075
Q11	.235	.774	.207	.014	-.040	-.157
Q12	.783	.248	.189	.310	.082	.065
Q14	.824	.382	.072	.109	-.086	-.076
Q15	.038	.844	-.015	.204	.115	.057
Q16	.347	.091	-.094	.209	.746	-.044
Q17	.258	.466	.485	.097	-.286	.061
Q18	.437	.611	.263	.049	-.086	.146
Q20	.787	.314	-.035	.071	.147	.172
Q21	.368	.503	.179	.044	.033	.548
Q23	.609	.536	.120	.084	.004	-.258
Q24	.352	.830	.085	-.030	-.015	.048
Q25	.323	.785	.122	.154	.298	.084
Q26	.426	.632	.085	.270	.205	-.123
Q27	.270	.727	.361	.182	-.022	.222
Q28	.219	.641	.101	.350	.270	.284
Q29	.812	.302	.187	.038	.149	.122
Q30	.832	.247	.047	.035	.035	.270
Rev_Q4	.013	.133	.628	.176	.004	-.617
Rev_Q5	.484	-.036	.343	.400	.431	.117
Rev_Q6	-.055	.200	.914	-.024	-.070	.053
Rev_Q13	.056	.134	.751	-.273	-.109	.289
Rev_Q19	-.017	.232	.708	.088	.375	-.115
Rev_Q22	.318	-.168	.711	.125	-.059	-.247

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 23 iterations.

Component Matrix[a]

	Component		
	1	2	3
Q1	.690	-.332	-.279
Q2	.700	-.022	-.344
Q3	.687	-.349	-.038
Q7	.678	-.137	.495
Q8	.241	-.001	.483
Q9	.815	-.154	.106
Q10	.379	-.083	.246
Q11	.721	.146	-.326
Q12	.797	-.071	.398
Q14	.837	-.163	.259
Q15	.636	-.034	-.491
Q16	.375	-.282	.246
Q17	.591	.413	-.093
Q18	.774	.118	-.156
Q20	.768	-.303	.207
Q21	.661	.011	-.226
Q23	.804	-.048	.082
Q24	.815	-.024	-.384
Q25	.832	-.020	-.285
Q26	.789	-.057	-.042
Q27	.791	.250	-.277
Q28	.694	-.018	-.224
Q29	.821	-.100	.266
Q30	.761	-.236	.248
Rev_Q4	.244	.640	.234
Rev_Q5	.488	.116	.495
Rev_Q6	.300	.881	-.042
Rev_Q13	.261	.674	-.113
Rev_Q19	.352	.635	.032
Rev_Q22	.268	.599	.511

Extraction Method: Principal Component Analysis.

a. 3 components extracted.

Rotated Component Matrix[a]

	Component		
	1	2	3
Q1	.736	.283	-.205
Q2	.759	.158	.086
Q3	.583	.469	-.185
Q7	.224	.815	.097
Q8	-.105	.496	.124
Q9	.575	.604	.053
Q10	.145	.434	.043
Q11	.750	.141	.255
Q12	.371	.794	.172
Q14	.497	.736	.072
Q15	.803	.012	.037
Q16	.159	.483	-.149
Q17	.480	.173	.518
Q18	.686	.309	.265
Q20	.489	.692	-.086
Q21	.652	.217	.127
Q23	.573	.552	.149
Q24	.873	.197	.104
Q25	.824	.281	.127
Q26	.641	.451	.118
Q27	.764	.193	.378
Q28	.679	.245	.107
Q29	.476	.716	.131
Q30	.451	.701	-.017
Rev_Q4	-.012	.157	.706
Rev_Q5	.056	.636	.297
Rev_Q6	.184	-.082	.909
Rev_Q13	.216	-.106	.690
Rev_Q19	.199	.069	.696
Rev_Q22	-.165	.393	.714

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

Communalities

	Initial	Extraction
Q1	1.000	.664
Q2	1.000	.608
Q3	1.000	.595
Q7	1.000	.723
Q8	1.000	.273
Q9	1.000	.699
Q10	1.000	.211
Q11	1.000	.647
Q12	1.000	.799
Q14	1.000	.795
Q15	1.000	.647
Q16	1.000	.281
Q17	1.000	.528
Q18	1.000	.637
Q20	1.000	.725
Q21	1.000	.489
Q23	1.000	.656
Q24	1.000	.812
Q25	1.000	.774
Q26	1.000	.628
Q27	1.000	.764
Q28	1.000	.532
Q29	1.000	.755
Q30	1.000	.696
Rev_Q4	1.000	.524
Rev_Q5	1.000	.496
Rev_Q6	1.000	.867
Rev_Q13	1.000	.535
Rev_Q19	1.000	.528
Rev_Q22	1.000	.692

Extraction Method: Principal Component Analysis.

```
RELIABILITY
  /VARIABLES=Q1 Q2 Q3 Q11 Q15 Q18 Q21 Q23 Q24 Q25 Q26 Q27 Q28
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA.
```

Reliability Statistics

Cronbach's Alpha	N of Items
.944	13

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	59.13	102.150	.703	.941
Q2	59.15	102.090	.713	.940
Q3	59.07	104.958	.621	.943
Q11	59.11	101.618	.738	.940
Q15	59.71	97.655	.726	.940
Q18	58.98	102.055	.718	.940
Q21	59.22	100.914	.631	.943
Q23	59.24	104.110	.712	.941
Q24	59.27	97.943	.865	.936
Q25	59.29	97.395	.858	.936
Q26	59.31	100.032	.751	.939
Q27	58.98	101.203	.796	.938
Q28	59.29	98.729	.712	.941

```
RELIABILITY
  /VARIABLES=Rev_Q5 Q7 Q8 Q9 Q10 Q12 Q14 Q16 Q20 Q29 Q30
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
```

Reliability Statistics

Cronbach's Alpha	N of Items
.888	11

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Rev_Q5	47.3455	73.786	.568	.418	.882
Q7	46.7273	71.906	.756	.659	.869
Q8	46.8000	79.978	.300	.317	.901
Q9	46.4545	77.215	.701	.770	.875
Q10	47.3636	77.421	.417	.332	.893
Q12	46.4364	74.176	.867	.798	.866
Q14	46.4727	74.217	.800	.822	.869
Q16	47.5636	76.991	.407	.397	.895
Q20	46.7455	73.267	.757	.722	.870
Q29	46.4000	76.281	.788	.793	.871
Q30	46.4182	75.766	.761	.771	.872

```
RELIABILITY
  /VARIABLES=Q17 Rev_Q4 Rev_Q6 Rev_Q13 Rev_Q19 Rev_Q22
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA.
```

Reliability Statistics

Cronbach's Alpha	N of Items
.834	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q17	23.7636	23.591	.493	.828
Rev_Q4	24.4182	20.655	.571	.816
Rev_Q6	24.1273	18.224	.840	.755
Rev_Q13	24.3091	20.403	.577	.815
Rev_Q19	24.3818	21.500	.602	.808
Rev_Q22	24.1818	21.263	.580	.813