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EVALUATION OF A SECURE LAPTOP BASED TESTING PROGRAM IN AN  
UNDERGRADUATE NURSING PROGRAM

by

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A dissertation in practice submitted in partial fulfillment of the requirements  
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at the University of Central Florida  
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## ABSTRACT

This applied dissertation paper introduced a program evaluation of a secure laptop-based testing (SLBT) program, which was implemented from 2009 to 2014 in an undergraduate nursing program at a private institution in the southeastern region of the United States (US).

Computerized testing is an old topic in the educational research field, but the instructor-made, laptop-based secure testing that utilizes learning management systems (LMS) for undergraduate nursing programs is a fairly new topic in the US. Traditionally, testing has been administered with paper and pencil in the undergraduate nursing programs in the US for security reasons. Recently, with different robust LMSs, together with availability of affordable laptops, SLBT has become a reality on many campuses.

The undergraduate nursing program at the Adventist University of Health Sciences (ADU) began to implement the SLBT program in 2009, which allowed students to use their newly purchased laptops to take secure quizzes and tests in their classrooms. After nearly five years' SLBT program implementation, a formative evaluation was conducted to seek constructive feedback from students, faculty, and technology support personnel to improve the program.

Evaluation data show that, overall, students believed the SLBT program help them get hands-on experience of taking exams on the computer and get them prepared for their National Council Licensure Examination for Registered Nurses (NCLEX-RN) which is also computerized. Students, however, had a lot of concerns on laptop glitches and campus wireless network glitches they experienced during testing. Faculty and technology support personnel, on the other hand, were very satisfied with the SLBT program.

Another goal of this evaluation study was to determine if students' first-time passing rate of NCLEX-RN has been improved significantly after the implementation of the SLBT program. NCLEX-RN first-time passing rate data were analyzed using the Chi-Square test and it revealed that there was no significant association between the two types of testing method (paper-and-pencil testing and the secure laptop-based testing) and whether or not students would pass NCLEX-RN the first time  $X^2(1) = 3.53, p > .05$ . Based on the odds ratio, however, the odds of students passed NCLEX-RN the first time were 1.37 times higher if they were taught with the SLBT testing method than if taught with the traditional paper-and-pencil testing method in nursing school.

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“I can do all things through Christ who strengthens me.” Philippians 4:13

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## TABLE OF CONTENTS

LIST OF FIGURES .....	x
LIST OF TABLES .....	xi
LIST OF ABBREVIATIONS/ACRONYMS.....	xii
CHAPTER ONE: INTRODUCTION.....	1
Background.....	2
The Secure Laptop-based Testing Program .....	3
Problem Statement.....	6
Evaluation Questions .....	7
Audience/Stakeholders .....	7
Purpose of the Program Evaluation .....	8
Evaluation Outcomes.....	8
Limitations .....	9
Professional Evaluation Standards.....	9
Evaluation Objectives .....	11
CHAPTER TWO: RESEARCH LITERATURE REVIEW .....	12
Computerized Testing .....	12
Computerized Testing in Nursing Education .....	15

Secure Laptop-based Testing Program at ADU .....	17
Program Evaluation .....	19
Evaluation Framework.....	24
Summary.....	25
<b>CHAPTER THREE: RESEARCH METHODOLOGY .....</b>	<b>27</b>
Introduction.....	27
Evaluation Questions .....	28
Study Design.....	28
Evaluation Model.....	29
SLBT Program Input.....	29
SLBT Program Activities.....	30
SLBT Program Output .....	30
SLBT Program Outcome .....	31
SLBT Program Impact.....	31
Study Population.....	33
Sample.....	33
Setting .....	33
Instruments.....	35
Data Collection .....	36



Data Analysis .....	37
Internal and External Validity .....	37
Data Analysis Methods .....	38
Summary .....	38
<b>CHAPTER FOUR: ANALYSIS AND RESULTS .....</b>	<b>40</b>
Introduction.....	40
Study Design.....	40
Demographic Data .....	41
Students Perception Data Analysis .....	45
Technology Support Personnel Perception Data Analysis .....	50
Nursing Faculty Perception Data Analysis .....	53
NCLEX-RN Passing Rate Data Analysis .....	58
Summary .....	62
<b>CHAPTER FIVE: DISCUSSION AND CONCLUSIONS .....</b>	<b>63</b>
Introduction.....	63
Discussion of Evaluation Question 1 .....	63
Discussion of Evaluation Question 2 .....	67
Discussion of Evaluation Question 3 .....	68
Discussion of Evaluation Question 4 .....	69

Discussion of Evaluation Question 5 .....	70
Discussion of Evaluation Question 6 .....	71
Discussion of Evaluation Question 7 .....	72
Discussion of Results of NCLEX-RN Passing Rate Data .....	74
Recommendations for the Organization .....	75
Conclusions .....	77
Recommendations for Future Research .....	78
APPENDIX A UCF IRB APPROVAL LETTER.....	81
APPENDIX B ADU IRB APPROVAL LETTER.....	83
APPENDIX C STUDENTS PERCEPTION SURVEY INSTRUMENT .....	85
APPENDIX D NURSING FACULTY SURVEY INSTRUMENT .....	87
APPENDIX E TECHNOLOGY SUPPORT PERSONNEL SURVEY INSTRUMENT.	90
APPENDIX F EVALUATION PLAN .....	92
APPENDIX G NCLEX-RN FIRST-TIME PASSING RATE.....	94
APPENDIX H SPSS OUTPUT .....	96
LIST OF REFERENCES .....	100

## LIST OF FIGURES

<i>Figure 1: The SLBT Model</i> .....	4
<i>Figure 2: Actual SLBT Testing in Process</i> .....	5
<i>Figure 3: The SLBT Program Logic Model</i> .....	29
<i>Figure 4: First-time NCLEX-RN Passing Rate Trend</i> .....	34
<i>Figure 5: Demographics of Nursing Students at ADU</i> .....	42
<i>Figure 6: Nursing Student Age Range Distribution at ADU</i> .....	43
<i>Figure 7: Demographics of Nursing Faculty at ADU</i> .....	44
<i>Figure 8: NCLEX-RN Passing Rate (2007-2013)</i> .....	59

## LIST OF TABLES

Table 1 Comparison of the Two Testing Models .....	19
Table 2 Differences between Formative and Summative Evaluations .....	22
Table 3 Advantages of Internal and External Evaluators.....	24
Table 4 Descriptive Statistics for Nursing Student Gender .....	42
Table 5 Descriptive Statistics for Nursing Faculty Gender .....	44
Table 6 Student Perception Survey Quantitative Data.....	46
Table 7 Student Perception Survey Qualitative Data (1).....	47
Table 8 Student Perception Survey Qualitative Data (2).....	49
Table 9 Technology Support Personnel Perception Survey Quantitative Data.....	51
Table 10 Technology Support Personnel Perception Survey Qualitative Data.....	52
Table 11 Faculty Perception Survey Quantitative Data .....	55
Table 12 Faculty Perception Survey Qualitative Data.....	57
Table 13 First-time NCLEX-RN Passing Rate Data.....	58
Table 14 Testing Strategy Data .....	60
Table 15 Chi-Square Test.....	61

## LIST OF ABBREVIATIONS/ACRONYMS

ADU	Adventist University of Health Sciences
Angel LMS	Angel Learning Management System
CET	Center for Educational Technology
CT	Computerized Testing
IT	Information Technology
LMS	Learning Management System
NCLEX-RN	National Council Licensure Examination for Registered Nurses
SLBT	Secure Laptop-based Testing
UCF	University of Central Florida

## CHAPTER ONE: INTRODUCTION

In the undergraduate nursing education in the United States (U.S.), in order to become registered nurses (RN) after graduation from the nursing program, graduate nursing students have to pass the computerized National Council Licensure Examination for Registered Nurses (NCLEX-RN). For many graduate nursing students, the computerized NCLEX-RN exam has posed a challenge as they haven't practiced taking exams and quizzes on the computer while in nursing school. Before 2000, paper-and-pencil based testing was the predominant testing method in the undergraduate nursing education in the U.S. (Anna, 1998). Until recently, most nursing programs in the U.S. still administered paper-and-pencil tests to students although the NCLEX-RN exam has been computerized in the U.S. since 1994. Tao, Lorentz, Hawes, Rugless, and Preston (2012) pointed out some drawbacks of the traditional paper-and-pencil based testing (PPBT) method in the nursing programs:

- 1) PPBT is time consuming for faculty to prepare the test;
- 2) PPBT uses a lot of paper to print hard copies of tests for students;
- 3) Grading and re-grading in PPBT take long time even using Scantron machines; and
- 4) PPBT is prone to human errors since it involves a lot of manual work.

Computerized testing, however, is not a new topic in the education field. Bull and McKenna (2000) concluded that computerized testing increases feedback to students and faculty, extends the range of assessment methods, broadens the range of knowledge assessed, and reduces marking loads for faculty. Noyes and Garland (2008) also pointed out the advantages of computerized testing:

- The richness of the interface

- Standardization of testing environment
- Online instant scoring

Despite so many advantages of computerized testing, nursing programs in the U.S. have been administering paper-and-pencil tests to students for a long period of time, due to reasons such as lacking of testing security, inadequate information technology resources, and unreliable technology support (Tao et al., 2012).

### Background

After 2000, with the availability of laptops and sophisticated learning management systems (LMS), instructor-made computerized testing became a reality on many campuses across the United States (Tao, Lorentz, Hawes, Rugless, & Preston, 2012). In fall 2004, the Nursing Department at the Adventist University of Health Sciences (ADU) implemented a laptop initiative program (LIP), which mandated that the first-year nursing students purchase a university deployed Dell laptop and use it throughout their nursing program. The proposed possible uses of the laptop during the nursing program included: computerized testing, online multimedia content reviewing, nursing related software application uses (such as Microsoft Word, PowerPoint, and Excel), online quizzes, and e-textbook access. From fall 2004 to spring 2009, however, laptops were mainly used by students to review online pre-recorded lectures, submit electronic assignments, and communicate with their instructors. Laptops were not used for secure testing purpose until the university started to use Angel™ learning management system (Angel LMS) in the fall of 2008. The LIP program did pave the way to the secure laptop-based testing (SLBT) program in two ways: 1) the university could pre-install Respondus Lockdown Secure Browser™ (RLSB) on all nursing students' laptops before the first exam; 2) troubleshooting laptop glitches during testing has become more manageable for technology

support personnel due to the same laptop brand and consistent software installation (Tao et al., 2012).

Before 2009, all tests and quizzes were conducted by paper-and-pencil in the nursing program at ADU. Starting spring 2009, the Nursing Department at ADU implemented the secure laptop-based testing program (SLBT) with the goal of preparing nursing students for the computerized NCLEX-RN and reducing nursing faculty workload related to testing. From 2009 to 2010, the Center for Education Technology (CET) Department worked with the Nursing Department and the Information Technology Department (IT) to fix the existing issues and glitches in the SLBT program, and the SLBT program has become mature ever since. Tao et al. did a pilot study in 2012 and they discovered that laptop-based testing (LBT) in undergraduate nursing programs offers the following advantages compared with paper-and-pencil testing:

- 1) LBT saves paper and printing ;
- 2) Students receive the grades right after they submit their tests ;
- 3) LBT gives students hands-on experience on taking tests on the computers; and
- 4) Re-grading and reviewing tests is easier for nursing faculty to manage.

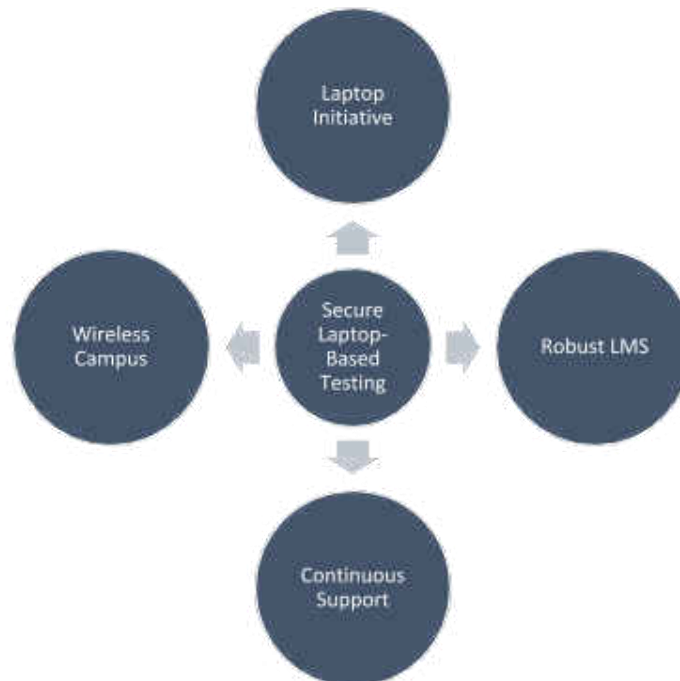
#### The Secure Laptop-based Testing Program

The Nursing Department began to implement the secure laptop-based testing (SLBT) program in spring 2009. The SLBT model (Tao et al., 2012) was summarized in the following chart (Figure 1). Four elements were considered the pillars for the success of the SLBT program:

- Component 1: The laptop Initiative Program (LIP). The LIP requests every student to purchase a new laptop from a university designated source. This laptop meets the minimum hardware and software requirements of conducting computerized tests.



- Component 2: Robust learning management system (LMS). All the tests questions are designed, developed, edited, and stored inside a sophisticated LMS (such as Angel LMS, or Blackboard-Learn). The Respondus Lockdown Browser™ (RLB) is third-party software the university has purchased for students to use for testing. Once installed and run on students’ laptops, the RLB locks up the laptop screen, only displaying testing questions for students to work on.
- Component 3: Wireless Campus. The entire ADU campus is covered with wireless Internet service and all enrolled nursing students have free access to it. This allows the students to retrieve test questions through the LMS.
- Component 4: Continuous Technology Support. Laptop, Internet, and LMS related glitches are inevitable to any computerized testing program; therefore, rigorous and continuous technology support to students and instructors is crucial to the success of the SLBT program.



*Figure 1: The SLBT Model (Tao, Lorentz, Hawes, Rugless & Preston, 2012)*

In the SLBT program at ADU, a typical secure nursing exam follows these procedures:

- On exam day, students bring their laptops to designated classrooms on campus to take the exam, and the exam is typically proctored by two instructors.
- When the exam time comes, students are promoted to clear their desks, only leaving their laptops, pencils and scratch paper ready for the exam.
- Once the exam starts, no bathroom break is allowed.
- Students are then prompted to run the Respondus Lockdown Browser (RLB), log in with their student identification (ID) and password to access the exam.
- The exams are password protected and the password is released by the instructor. With the password, students can access the exam and start to work on test questions (Figure 2).
- Students can only work on the exam questions within the RLB. They can't print-screen, print hard copies, copy and paste, or search on the Internet during testing.
- They submit the test once they finish the exam, and grades will be presented to them on the screen right away.
- Instructors then can choose to re-grade questions or conduct exam reviews.



*Figure 2: Actual SLBT Testing in Process (Tao et al., 2012)*

The SLBT program has been implemented since 2009; after 5 years, it was time to conduct a formative internal evaluation. A list of internal-specific questions were used to guide this evaluation:

- What are students, faculty, and technology support personnel's satisfaction level (1 to 5 scale) on the overall SLBT program?
- Can SLBT program simulate most of the questions formats that appear on the National Council Licensure Examination for Registered Nurses (NCLEX-RN)?
- Do students, faculty, and technology personnel feel the SLBT program helps students better prepare for the computerized NCLEX-RN exam?
- Do faculty feel the SLBT program helps reduce their workload related to testing, compared with paper-and-pencil testing?
- Are exam administering, exam re-grading, and exam reviewing manageable for nursing faculty?
- Is the laptop-based testing secure?
- If glitches happen during laptop-based testing, can technology support people resolve them quickly?
- Looking at students' first-time passing rate of the NCLEX-RN, is there any difference before and after the implementation of the SLBT program?

#### Problem Statement

Since 2009, working with the Information Technology (IT) Department and the Nursing Department, the Center for Educational Technology (CET) Department has been in charge of supporting the SLBT program. Two full-time educational technologists were staffed to support

secure exams for 10 undergraduate level nursing courses. CET laid out three major goals of the SLBT program in 2009:

1. Present all tests on students' laptops in a secure way where students can only engage in testing related activities.
2. By taking exams on their laptops, students are exposed to computerized testing, which will help them on their future computerized NCLEX-RN exam.
3. Laptop-based testing reduces faculty's workload related to test preparation, test question management, test administration, test re-grading, and test reviewing.

Since the initial SLBT program implementation in 2009, no formal evaluation was conducted to see its merits and drawbacks. After the development and implementation of the SLBT program, several problems were recognized. First, very little was known if the students, faculty, and technology personnel are satisfied with the program; second, little is known if the technology support is adequate; third, little is known if the SLBT program is impacting students' performance on the NCLEX-RN exam.

#### Evaluation Questions

The following two main evaluation questions were used to guide this study:

1. How is the SLBT program perceived by students, faculty, and technology support personnel?
2. Is there any relationship between two different testing methods (paper-and-pencil testing and secure laptop-based testing) and students' NCLEX first-time passing rate?

#### Audience/Stakeholders

All 185 current nursing students from ADU, 17 ADU nursing faculty, 2 technology support personnel, and the Nursing Department at ADU as an organization were the stakeholders

of this SLBT program evaluation. Another easily ignored group of stakeholders were those nursing students who didn't finish the nursing program due to failing grades or personal situations. The potential stakeholders were the future nursing students, the future ADU nursing faculty, and the future new technology support personnel.

### Purpose of the Program Evaluation

Without the valuable feedback from students, faculty, and technology support personnel, the university could not make any tangible improvement on the SLBT program. Thus the main purpose of this evaluation study was to seek constructive feedback from students, faculty, and technology support personnel to improve the SLBT program. Another purpose of this evaluation was to see if students' first-time passing rate of NCLEX-RN improved significantly after the implementation of SLBT program.

### Evaluation Outcomes

All data gathered from this study were analyzed to work on strategies to improve this SLBT program. The evaluation addressed the following short-term and long-term intended outcomes of the SLBT program. The short-term intended outcomes from the SLBT program were:

- The program provides students a smooth experience to take computerized exams
- The program exposes students to a computerized testing environment that mirrors the NCLEX-RN exam in terms of question formats, testing modality, and security.

The long-term intended outcomes from the SLBT program were:

- By participating in the SLBT program, students feel comfortable taking computerized exams, thus they may perform better on their future NCLEX-RN exam
- By running the SLBT program, nursing faculty have decreased workload in terms of test preparation, administration, reviewing, and re-grading.

### Limitations

This internal evaluation provided valuable, formative evaluation for program improvement to the program managers and institution administrators. On the other hand, the internal evaluation has some disadvantages. For example, the internal evaluators can be less objective during the evaluation process and can have bias to the evaluation results. During evaluation, internal evaluators can get distracted by irrelevant activities of the program and thus can't give complete attention to the evaluation process (Fitzpatrick, Sanders, & Worthen, 2011).

Another limitation came from the data from the first-time NCLEX-RN passing rate. The Nursing Department at ADU only kept the data from the students who took the NCLEX-RN within the State of Florida. During the last six years, nearly 20% of the ADU nursing graduates took their NCLEX-RN exam outside of the Florida state, thus the data analysis couldn't depict the most accurate picture of first-time passing rate difference.

### Professional Evaluation Standards

The Joint Committee on Standards for Educational Evaluation (JCSEE.org) has developed a set of standards for the evaluation of educational programs (Yarbrough, Shulha, Hopson, & Caruthers, 2011). This SLBT program evaluation focused on the following utility standards:

- **U1 Evaluator Credibility** - The evaluation was conducted by a qualified evaluator who maintained credibility in the organization. The evaluator was a doctoral student who finished a graduate level course on program evaluation.
- **U2 Attention to Stakeholders** - Evaluations devoted attention to a wide range of stakeholders who invested in the program and who were affected by its evaluation results.
- **U3 Negotiated Purposes** - The evaluation purposes were identified and the evaluator communicated with the organization administration during the entire evaluation process to make sure the purposes of the evaluation met the needs of all major stakeholders.
- **U4 Explicit Values** - The evaluation clarified the evaluator's non-judgmental value that underpinned the evaluation purposes, processes, and judgments.
- **U5 Relevant Information** - The evaluation result was useful and it served the needs of all major stakeholders.
- **U6 Meaningful Processes and Products** - The evaluation constructed activities, descriptions, and judgments to encourage all stakeholders to rediscover, reinterpret, or revise their understandings and behaviors.
- **U7 Timely and Appropriate Communicating and Reporting** - The evaluation attended to the continuing information needs of all major stakeholders during the entire evaluation process.
- **U8 Concern for Consequences and Influence** - The evaluation promoted responsible, positive, and adaptive use of the evaluation results.

### Evaluation Objectives

There were two major evaluation objectives of this evaluation study:

- 1) Collect constructive feedback from students, faculty, and technology support in order to improve the SLBT program;
- 2) Determine if there is any relationship between two different testing methods (paper-and-pencil testing and laptop-based testing) and students' first-time NCLEX-RN passing rate.



## CHAPTER TWO: RESEARCH LITERATURE REVIEW

### Computerized Testing

Computerized testing, also known as computer-based testing (CBT), refers to administering and managing tests on the computer (Davey, 2005). CBT has been around for over 60 years. Compared to the traditional paper-and-pencil testing (PPT) method, computerized testing offers many advantages: enhanced reliability, fast delivery, immediate scoring and feedback for both students and instructors, and reduced human errors (Tippins et al., 2006; Niemeyer, 1999). Because of those advantages, CBA has been drawing attention in the education field ever since 1980s in the United States (U.S.). Computerized testing also makes computer adaptive testing (CAT) possible by forming an individual test dynamically based on a test-taker's answers to a combination of questions (Niemeyer, 1999). One of first large-scale CAT programs was the College Board's ACCUPLACER® testing program started in 1985 (Luecht & Sireci, 2011). This relatively low-stake test was introduced to assist in placing entering college students in mathematics and English courses. The first high-stake CAT was the Novell corporation's certified network engineer (CNE) exam, which went online at Drake Prometric testing centers in 1990 (Luecht & Sireci, 2011). In 1992, the Educational Testing Service's (ETS) Graduate Record Examination (GRE) was computerized and its CAT program was operationally deployed at Sylvan testing centers across the U.S. (Eignor et al., 1993; Mills & Stocking, 1996). The NCLEX-RN examinations for nurse candidates was implemented using a CAT format at commercial testing centers in 1994 (Zara, 1994).

Most of the prior research on testing has been focusing on the CAT, however, some evaluations conducted on computerized testing was on instructor-made testing (Herman &

DorrBremme, 1982; Haynie, 1983, 1990). Computerized instructor-made tests became common on campuses due to the arrivals of the sophisticated learning management systems (LMS) such as WebCT™, Angel Learning, and Blackboard Learn™ (Tao & Li, 2012). Jacobsen & Kremer (2000) conducted a study on the automatic grading in computerized testing using the WebCT LMS. Instructors constructed and administered a midterm examination made up of randomly selected questions from test banks within the WebCT LMS. Questions were automatically scored by the WebCT LMS and they found the WebCT LMS offered an effective computerized testing environment.

Prior research also has shown a range of reasons and motives for implementing computerized testing programs on campuses (Bull & McKenna, 2000). Some of the key motives cited by Bull and McKenna include:

- Providing immediate feedback to students and instructors
- Increasing objectivity
- Higher testing frequency so students are more motivated to learn and practice skills
- Broadening the range of knowledge-based assessments and testing methods
- Increasing administrative efficiency
- Reducing instructors' marking loads.

With any type of testing, there are also disadvantages with computerized testing. For example, computerized testing systems can be expensive to develop and implement and may not be suitable for every assessment situation (Bull & McKenna, 2000; Tao et al., 2012). Computer hardware can be subject to malfunctioning and computer software can freeze and crash during testing, thus testing time can be wasted while computers have to be repaired or rebooted in order

for tests to resume. Also, for longer tests, computer screens may be more tiring to work on compared with paper-and-pencil testing (Ziefle 1998).

Naturally, the introduction of computerized testing in the education setting has raised concern about the equivalence between computerized testing and conventional paper-and-pencil testing. Prior research has mixed findings. Bunderson, Inouye & Olsen (1989) summarized the general pattern of findings from several studies, and they reported that, in general, students performed better on the paper tests than on the computerized tests. Goldberg & Pedulla (2002) also reported that the paper-and-pencil testing mode of Graduate Record Examination (GRE) outperformed the computerized GRE testing mode. Other studies have shown that students had lower performance on computerized testing because of scrolling requirements when answering test questions (Way, Davis & Fitzpatrick, 2006) or test questions that require graphing (Ito & Sykes, 2004; Keng, McClarty & Davis, 2006). Clariana & Wallace (2002), however, found that computer-based test students outperformed the paper-based test students in an undergraduate business program setting in the United States. Mead and Drasgow (1993) in their meta-analyses, on the other hand, stated there were no testing mode effects for the power tests they analyzed. Wang (2004) also found no mode effects for the Stanford Diagnostic Reading and Mathematics tests. Similarly, Poggio, Glassnapp, Yang, & Poggio (2005) stated there was no meaningful statistical differences in the paper-and-pencil mode and the computerized testing mode, given the same students with the identical test content.

There are other issues and controversies in computerized testing. Nowadays, due to large class sizes, many institutions deem computerized testing as a necessity. Cheating has become serious issues for many instructors (Cizek, 1999; Lathrop and Foss, 2000; Dick et al., 2003; Kantrowitz et al., 2011; Tao & Li, 2012). Rogers (2006) reported on instructors' perceptions on

cheating in a computerized testing program. He indicated that more than half of the instructors on his campus adopted computerized testing and some instructors had concerns on their students' cheating behaviors, but the most of the instructors didn't implement any measures to prevent cheating activities. In an attempt to curb cheating activities in computerized testing, randomization of test questions is often used so that neighboring screens present different test questions to the test-taker (Rogers, 2006). Marks & Cronje (2008), however, argued this test questions randomization could pose a disadvantage to the students who had more difficult questions at the beginning of their tests. Earlier in 1998, Greenberg also voiced his concerns regarding computer literacy and pointed out that computerized testing could potentially discriminate against those with less computer literacy (Greenberg, 1998).

#### Computerized Testing in Nursing Education

In the 1990s, paper-and-pencil based testing was the predominant testing format in the undergraduate nursing education in the United States (Anna, 1998). Comparing with paper-and-pencil testing, computerized testing has been found to be more efficient as students typically spend less time on testing (Olsen, 1990). Halkitis and Leahy (1993) reported that it was important for nursing students to practice with computerized testing prior to taking the computerized National Council Licensure Examination for Registered Nurses (NCLEX-RN). Bugbee (1996) demonstrated that paper-and-pencil testing and computerized testing were equivalent, especially with the same students taking the identical tests. Bloom and Trice (1997) also reported that students who took the computerized tests during their nursing program did just as well as those who took the paper-and-pencil tests.

Until recently, most nursing programs in the United States (US) still administered paper-and-pencil tests to students although the National Council Licensure Examination for Registered

Nurse (NCLEX-RN) has been computerized since 1994 in the US. (Anna, 1998). Instructor-made computerized testing in undergraduate nursing programs was still considered as an emerging technology at the end of 1990s (Anna, 1998). After 2000, however, commercial companies started to offer secure Internet-based testing programs in the US. ExamSoft™, for example, has served hundreds of prominent academic, certification, and licensing in the United States since 1998 (ExamSoft, 2014).

Reising (2003) compared the students who were exposed to computerized testing during their nursing programs and the students who were only exposed to paper-and-pencil testing and he reported no significant differences in the two groups' NCLEX-RN passing rates. In order to enhance student comfort with the format and structure of the computerized NCLEX-RN exam, however, a growing number of nursing programs started to use NCLEX-RN testing simulations and more campuses started to implement computerized testing programs for their students.

Jacobs and Koehn (2006) reported that using Assessment Technologies Institute (ATI™) service to implement computerized testing in nursing programs can provide nursing students hands-on experience with computerized testing prior to taking the high-stake NCLEX-RN exam and can increase the students' NCLEX-RN passing rate. Vrabel (2004) identified several advantages of personal-computer-based testing: increased security, immediate scoring and feedback for students and instructors, and scheduling convenience. Vrabel, however, also identified one possible disadvantage: computerized testing may increase testing anxiety for those students without previous experience. Fuszard (1999), however, concluded that anxiety associated with computerized testing could decrease with regular hands-on practice on the computer.

One way to implement computerized testing is to utilize computer laboratories. The College of Business Administration at the University of Central Florida (UCF), for example, set

up a computer testing lab to administer online exams to students in 2003 (Moskal & Caldwell, 2009). In 2008, as Moskal and Caldwell reported, over 120,000 exams were administered in this lab at UCF. The greatest benefit of utilizing a computer lab to administer tests is its increased security due to two reasons: the proctor presence and students have to leave the computers behind after the test. Consistent technology support and exam scheduling, however, can become very difficult when facing increased testing demand (Moskal & Caldwell, 2009). In addition to the cost, instituting computer testing labs can also be very challenging for campuses who are facing limited financial and technology resources (Dibartolo & Seldomridge, 2008).

#### Secure Laptop-based Testing Program at ADU

As more campuses are migrating to the blended learning model that often utilizes robust learning management systems (LMS), along with the dramatic increase of students' personal laptop usage due to reduced laptop prices, the secure laptop-based testing (SLBT) has become a very viable option for many campuses to administer tests (Tao et al., 2012). According to Tao et al., the instructor-made SLBT is made possible by satisfying those two conditions: 1) from faculty's perspective, institutions need to utilize a robust LMS that allows instructors to create and host test questions. Testing features and functions of the LMS such as one question at a time with no backtrack, randomization of question orders, automatic grading and re-grading, specific testing time setting, and extended time setting for students with special needs are also available for faculty to use; 2) on the students' end, test questions are presented in a secure browser where minimizing windows, searching for online answers, opening new windows, printing, and right clicking are all prevented. In recent years, third party secure testing software began to emerge in the higher education setting. Angel Secure Browser 2.0 was released in 2008 by Angel Learning Management System (Angel LMS, Angel LMS was acquired by Blackboard Learn™ in 2009),

and it was a major breakthrough to make secure laptop-based testing a reality. Students could download and install the Angel Secure Browser on their laptops. When the testing time comes, students launch the Angel Secure Browser, the laptop screen is locked down so that students can't do anything except working on the test questions. There were two weaknesses associated with the Angel Secure Browser, one being that it was Windows-based and didn't work with the Macintosh operating systems; secondly, the Angel secure browser was only available to the Angel LMS users. The Respondus Lockdown Browser™ (RLB, also released in 2008) by Respondus™ is another secure browser for instructor-made testing. Once the RLB is launched on the computer, the desktop screen will be locked down; and it prevents students from printing, copying and pasting test content. The RLB works well with other learning management systems such as Instructure Canvas, Blackboard-Learn, Sakai, or Moodle, and it is also compatible with both personal computers and Macintosh computers (Tao et al., 2012)

The Nursing Department at the Adventist University of Health Sciences (ADU), with the help from the Center for Educational Technology (CET) Department and the Information Technology (IT) Department, has designed, developed, and implemented the SLBT program since 2009. In 2012, Tao et al. compared the traditional computer-lab testing model and the laptop-based testing model in the following Table 1.

Table 1

Comparison of the Two Testing Models

<b>Computer Lab Testing Model</b>	<b>Laptop-based Testing Model</b>
Typically using desktop computers fixed in the lab, thus low portability	Students bring laptop computers to campus for testing, thus high portability
Typically fixed space only for testing purpose	Any classroom can be used for testing
High cost to school, low cost to students	Low cost to school, moderate cost to students
High security, proctor required	Acceptable security, proctor required
Requires technology and scheduling support	Requires technology support
Computer and Internet resources are typically limited to only testing purpose	Laptop and Internet resources can also be utilized for various learning related activities

Tao et al.'s 2012 study revealed that laptop-based testing model has many advantages over the conventional lab-based testing model: laptops are more portable and flexible than desktop-computers. For many institutions where students are asked to purchase the laptops from a specific source, their students also have greater sense of ownership over their laptops. Besides testing, students can use their laptops to engage in other educational activities such as watching online streaming lectures, conducting online case studies, submitting homework within the LMS, and communicating with their professors (Tao et al., 2012). With the laptops becoming more affordable in the United States, instructor-made laptop-based testing has become more viable in recent years (Tao et al., 2012)

### Program Evaluation

Program evaluation is a systematic method for collecting, analyzing, and using information to judge the effectiveness and efficiency of programs, projects, and policies



(Administration for Children and Families, 2010). The basic goal of program evaluation is to render judgments about the value of the program (Scriven, 1996). In recent years, although formal evaluation in education setting is still maturing as a field, the profession of program evaluation is growing in leaps and bounds (LaVelle & Donaldson, 2010). The Joint Committee on Standards for Educational Evaluation (1994) defined program as “activities that are provided on a continuing basis” (p. 3). In 2010, the Joint Committee redefined the term program by adding more specifications. Defined completely, a program is:

- “A set of planned systematic activities
- Using managed resources
- To achieve specified goals
- Related to specific needs
- Of specific, identified, participating human individuals or groups
- In specific contexts
- Resulting in documentable outputs, outcomes and impacts
- Following assumed (explicit or implicit) systems of beliefs (diagnostic, causal, intervention, and implementation theories about how the program works) with specific, investigable costs and benefits” (Fitzpatrick et al., 2011, p.8).

In 1982, Talmage pointed out that an important purpose of program evaluation was to “assist decision makers responsible for making policy” (p. 594). For many years, program evaluation has been used for program improvement. Today, many still consider program improvement as the main purpose of program evaluation (Preskill & Torres, 1998; Mark, Henry, & Julnes, 2000; Patton, 2008; Fitzpatrick, Sanders, & Worthen, 2011). Program managers or those who deliver a program can use the evaluation findings to make changes to improve the

program. Finally, many evaluators continue to acknowledge another purpose of evaluation in extending knowledge (Donaldson, 2007; Mark, Henry, & Julnes, 2000). Although extending knowledge is the main purpose of research, evaluation studies can also add to knowledge of the social science field (Fitzpatrick et al., 2011).

One of the important elements of a program is stakeholders. Stakeholders are individuals who are affected by the program, who have a direct interest in the program, or who are affected by the evaluation's results (Fitzpatrick et al., 2011). Greene (2005) identified four types of stakeholders:

- “People who have direct responsibility for the program
- People who are the intended beneficiaries of the program
- People who have authority over the program
- People who are disadvantaged by the program” (pp. 397-398)

There are two types of program evaluations: formative and summative. Scriven (1967) first distinguished between the formative and summative evaluations. The primary purpose of formative evaluation is to provide information for program improvement (Fitzpatrick et al., 2011). In contrast to formative evaluation, Scriven (1991) has defined summative evaluation as “evaluation done for, or by, any observers or decision makers (by contrast with developers) who need conclusions for any other reasons besides development” (p. 20). The primary purpose of summative evaluations is to provide information to help decision-makers to make judgments about program continuation, adoption, or expansion. Fitzpatrick et al. (2011) summarized the differences between formative evaluation and summative evaluation in the following Table 2:

Table 2

## Differences between Formative and Summative Evaluations

	Formative Evaluation	Summative Evaluation
Use	To improve the program	To make decisions about the program's future or adoption
Audience	Program managers and staff	Administrators, policymakers, or potential consumers
By Whom	Often internal evaluators	Often external evaluators
Major Characteristics	Provides feedback so program managers can improve it	Provides feedback to enable administrators to decide whether to continue it or consumers to adopt it
Purpose of Data Collection	Diagnostic	Judgmental
Frequency of Data Collection	Frequent	Infrequent
Sample Size	Usually small	Usually large
Questions Asked	What needs to be improved? What is not working? How can it be improved?	What results occur? Under what conditions? With whom?

Formative and summative evaluations are often not as easy to distinguish in the real world as they seem on the textbooks. Scriven (1991) has acknowledged that, in practice, formative and summative evaluations are often profoundly intertwined and the line between the two is often ambiguous.

There are also two types of evaluators: external evaluator and internal evaluator. The internal evaluations are often conducted by program employees and the external evaluations are often conducted by outsiders (Fitzpatrick et al., 2011). Internal evaluators have many advantages

over external evaluators: internal evaluators often know more about the program and its challenges than any outsiders; internal evaluators often know more about the organization and styles of decision-makers than any outsiders; internal evaluators are also less threatening as they are already familiar with the all stakeholders of the program; internal evaluators will remain with the organization after the evaluation so they can continue to serve as advocates for use of evaluation findings; lastly, internal evaluators are typically less costly (Fitzpatrick et al., 2011). Therefore, internal evaluators can conduct useful and formative evaluation for program improvement directly to program managers or directors (Lambur, 2008). The emphasis of internal evaluators should be on program improvement (Patton, 2008).

On the other hand, the internal evaluators have their known disadvantages: they may have bias; they may not be adequately trained as professional evaluators; and they may be more preoccupied with irrelevant program activities and not give the evaluation complete attention (Fitzpatrick et al., 2011). The strength of external evaluators, on the other hand, lies in their distance from the program and their professionally trained expertise (Fitzpatrick et al., 2011). External evaluators are typically more objective and credible by the public and policy-makers. Fitzpatrick et al. (2011) summarized the advantages of internal and external evaluators in the Table 3:

Table 3

Advantages of Internal and External Evaluators

<i>Internal</i>	<i>External</i>
More familiar with program and organization in terms of history, clients, and culture	Tend to be more objective
More familiar with organization’s decision-making style	Tend to be more credible to the public
Stay within the organization after the evaluation thus can increase evaluation results use	Are typically professionally trained evaluators, thus can bring more depth of technical expertise
Typically less threatening to program stakeholders and less expensive	Have knowledge of how other similar programs work

In addition to its potential for impact, program evaluation has its limitations. Fitzpatrick et al. (2011) pointed out the following possible limitations of program evaluation:

- Methods of evaluation may not be the most effective;
- Evaluation may not go well with politics; and
- Evaluators and clients may not have a positive view on evaluations.

Evaluation Framework

In recent years, the most adopted program evaluation approaches are the objectives-oriented approach and logic-model-based approach (Fitzpatrick, Sanders, & Worthen, 2011). Objectives-oriented evaluation focuses on the extent to which objectives of a program are actually achieved (Tyler, 1942). This approach compares performance data with behaviorally stated objectives to see if there are any discrepancies. The objectives-oriented approach dominated the evaluation profession since the 1930s in the United States (Madaus &

Stufflebeam, 1989). The objectives-oriented approach is easy to understand and implement, and it can produce relevant information to the mission of the program (Fitzpatrick et al., 2011).

The objectives-oriented evaluation approach, however, often has single-minded focus on the program objectives and the measurement, and thus often ignoring how the program achieves its objectives. Recently, logic models have been designed as an important extension of the objectives-oriented approach and logic models have been developed to fill in the steps between programs and their objectives (Fitzpatrick et al., 2011). The logic-model-based evaluation has become one of the most rapidly growing areas of objectives-oriented evaluation (Weiss, 1995; Donaldson, 2007). Fitzpatrick et al. (2011) stated that logic models usually require program evaluators to identify program inputs (facilities, materials, resources, and equipment), program activities (training sessions, weekly sessions, conferences, workshops, and services delivered), program outputs (immediate program impacts), and program outcomes (longer-term goals for participant change).

### Summary

Computerized testing is a popular and controversial topic in the educational research literature. A lot of research efforts have been devoted to high-stake, large scale computerized adaptive testing, while research on laptop-based, LMS-based, and instructor-made testing is limited. The prior research in computerized testing in nursing education showed that computerized testing has many advantages over conventional paper-and-pencil testing. Due to many reasons such as lacking of testing security, inadequate information technology resources, and inconsistent technology support, however, undergraduate nursing programs in the United States has been adopting paper-and-pencil testing method for a long period of time. As more campuses started to use robust learning management systems (LMS) such as Angel Learning,

Blackboard Learn, Instructure Canvas, Moodle, or Sakai, together with stable campus-wide wireless Internet service to students, LMS-based secure testing has become viable on many campuses in the United States. Tao et al.'s pilot study (2012) revealed that secure laptop-based testing (SLBT) in undergraduate nursing program in the United States was implementable if four elements were satisfied: laptop initiative, robust LMS, stable wireless campus, and continuous technology support.

For many years, program evaluation has been used for program improvement. Objectives-oriented evaluation focuses on the extent to which program objectives are actually achieved and it compares performance data with behaviorally stated objectives to see if there are any discrepancies. Internal evaluators have many advantages over external evaluators and they can conduct formative evaluations to the people who are running the program. Internal evaluators, in contrast to external evaluators, are typically perceived less credible by the public and they may have bias toward the program they are evaluating.

## CHAPTER THREE: RESEARCH METHODOLOGY

### Introduction

In 2004, sensing the importance of using laptops in teaching and learning, the Nursing Department at Adventist University of Health Sciences (ADU) worked with the Center for Educational Technology (CET) Department and the Information Technology (IT) Department to create the Laptop Initiative Program (LIP). The LIP mandated that all entry nursing students to purchase laptops to use in their entire nursing program. From fall 2004 to spring 2009, laptops were mainly used in the classroom for students to review online pre-recorded lectures and conduct various online learning activities. Laptops were not used for testing purposes until the university started to use Angel™ learning management system in the fall of 2008. Two major benefits of the LIP program paved the way toward the secure laptop-based testing (SLBT) program. First, the university pre-installed Respondus Lockdown Browser™ (RLB) on every student's laptop before the first exam. Second, troubleshooting laptop-related glitches became manageable for technology support personnel due to the same laptop brand and the same software installation (Tao et al., 2012). Since spring 2009, the Nursing Department, with the support from CET and IT departments, began to implement the SLBT program. Four major components (the laptop initiative, sophisticated learning management system (LMS), stable wireless campus, and continuous technology support) were considered the pillars of the SLBT program (Tao et al., 2012).

After nearly five years of implementation of the SLBT program, a formative evaluation was needed to seek feedback from the program major stakeholders to further improve the program. Thus, the main purpose of this evaluation study was to seek constructive feedback from



students, faculty, and technology support personnel to improve the SLBT program. Another purpose of this evaluation was to see if students' first-time passing rate of NCLEX-RN improved significantly after the implementation of SLBT program. In order to conduct a formative and systematic evaluation, the evaluator drafted a detailed evaluation plan in fall 2013 (see Appendix F), and all evaluation related activities followed this plan from beginning of fall 2013 (when the evaluation started) to the end of spring 2014 (when the evaluation ended).

### Evaluation Questions

The following two main evaluation questions were used to guide this study:

1. How is the SLBT program perceived by students, faculty, and technology support personnel?
2. Is there any relationship between two different testing methods (paper-and-pencil testing and secure laptop-based testing) and students' first-time NCLEX-RN passing rate?

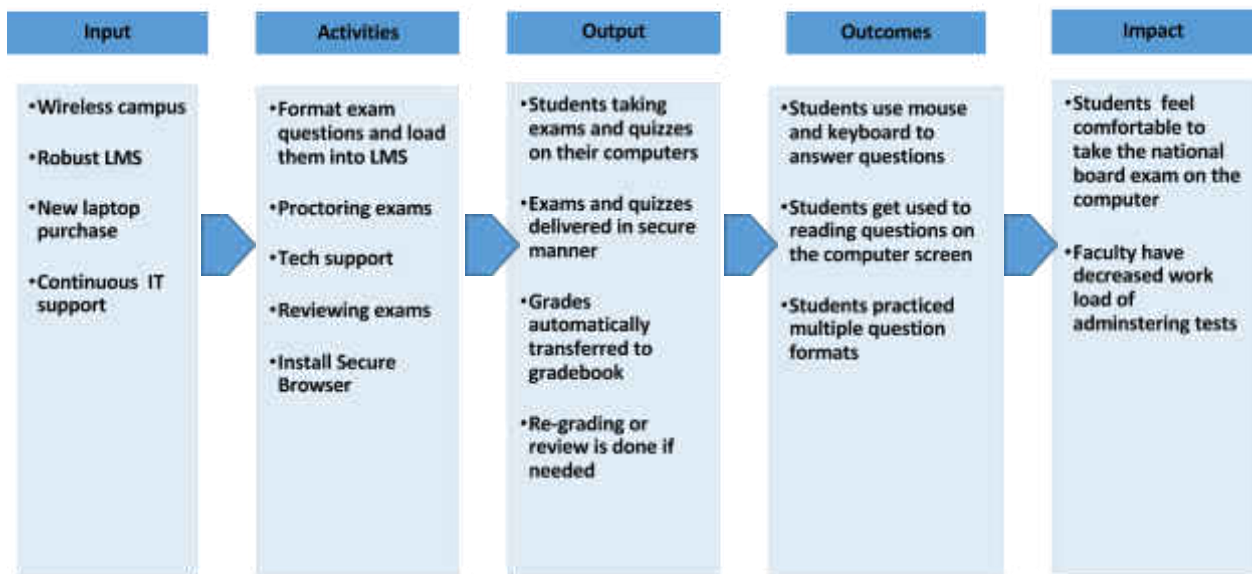
### Study Design

The design used for this study was a mixed method evaluation study that used the descriptive and correlational data elements. Descriptive evaluation approach was needed due to the nature of the study: program evaluation. Descriptive evaluation is especially suitable in determining whether a program's performance is at the desired level (Fitzpatrick, Sanders, & Worthen, 2011). Open-ended questions in the surveys were designed to collect both quantitative and qualitative data to describe how students, faculty, and technology support personnel perceive the secure laptop-based testing (SLBT) program. The design also had a correlational element because the first-time passing rate of NCLEX-RN three years before and three years after the implementation of the SLBT program were compared to see if there was any difference between

the two testing methods: the laptop-based secure testing and the conventional paper-and-pencil testing.

### Evaluation Model

The logic model this evaluation study followed was summarized in the following Figure 3, followed by detailed elaborations:



*Figure 3: The SLBT Program Logic Model*

#### *SLBT Program Input*

The SLBT program requires the following resources:

- A campus-wide stable wireless Internet access for students
- A robust learning management system (LMS) to store and manage all online exam questions

- Newly admitted nursing students purchase new laptops that have required hardware and software
- Technology support personnel troubleshoot laptop related glitches and LMS related glitches
- Faculty manage and implement online exams with technology support

### *SLBT Program Activities*

On faculty side, exam questions are formatted and hosted in the LMS with the help of technology support personnel. Faculty review the exams before the exams are published to students. On the exam day, faculty proctors the exam in the classroom. On students' side, they bring their laptop to class on the exam day, launch Respondus Lockdown Browser™ and start the exam. After finishing answering all questions, they submit the exam and they see their grades immediately. The technology support personnel, on the other hand, help faculty load and manage exam questions in the LMS. On the exam day, they go to the classroom to troubleshoot any laptop and LMS related glitches before the start of the exam. After the exam, they help faculty re-grade exam questions if necessary.

### *SLBT Program Output*

Computerized secure exams and quizzes are delivered to the students via their laptops in a secure manner. Students take the exams on the designated time frame and classroom location, and their grades are transferred automatically to the LMS gradebook. Exam review will be conducted if it is determined necessary by the faculty. Exam questions are then re-graded by faculty with help from the technology support if needed.

### *SLBT Program Outcome*

By taking the secure online exam and quizzes on their laptops, students have practiced using mouse and keyboard to select or enter answers, and they become used to viewing exam questions on the screen. Students also practiced various question formats such as multiple-choice, multiple-select, ordering, matching, and fill-in-the-blanks, which also appear on their future computerized NCLEX-RN exam.

### *SLBT Program Impact*

Students will feel comfortable taking NCLEX-RN exam on the computer. By administering exams on the computer during the nursing program, nursing faculty will have a decreased workload in terms of test preparation, administration, scoring, re-grading, and test reviewing.

This evaluation study adopted the objective-oriented approach due to the fact that the SLBT program had clear objectives set by ADU in 2009:

1. Present all tests on students' laptops in a secure way where students can only engage in testing activities.
2. By taking exams on their laptops, students become used to computerized testing, which will better prepare them for their future computerized NCLEX-RN exam.
3. Computerized testing reduces faculty's workload related to test preparation, test question management, test administration, re-grading, and test reviewing.

The logic model-based evaluation is one of the most rapidly growing areas of evaluation (Weiss, 1995; Donaldson, 2007). Objectives-oriented evaluation focuses on the extent to which objectives of a program are actually achieved (Tyler, 1942). A list of internal specific

evaluation questions were designed based on the above objectives and were used to guide this evaluation study:

- What are students, faculty, and technology support personnel's satisfaction level (1 to 5 scale) on the overall SLBT program?
- Can SLBT program simulate most of the questions formats that appear on the National Council Licensure Examination for Registered Nurses (NCLEX-RN)?
- Do students, faculty, and technology personnel feel the SLBT program helps students better prepare for the computerized NCLEX-RN exam?
- Does faculty feel the SLBT program helps reduce their workload related to testing, compared with paper-and-pencil testing?
- Are exam administering, exam re-grading, and exam reviewing manageable for nursing faculty?
- Is the laptop-based testing secure?
- If glitches happen during laptop-based testing, can technology support people resolve them quickly?
- Looking at students' first-time passing rate of the NCLEX-RN, is there any difference before and after the implementation of the SLBT program?

These evaluation questions can be summarized into two main evaluation questions:

- How is SLBT program perceived by students, faculty, and technology support personnel?
- Looking at the first-time pass rate of the NCLEX-RN exam, is there any difference before and after the implementation of SLBT?

This was an internal evaluation where the evaluator was one of the two technology support personnel. Internal evaluators typically know more about the program, the organization,

and policy-makers' decision making style. Therefore, internal evaluators can provide valuable and formative evaluation for program improvement (Lambur, 2008). Internal evaluators can also help increase the use of the evaluation results since internal evaluators will often remain with the organization after the evaluation. On the other hand, the most obvious disadvantage that internal evaluators have is their potential bias toward the program they are evaluating. This study notes that researcher bias may have played a significant part in this segment of the evaluation process. Research bias can be defined as any propensity, which suggest prejudiced to questions asked, however, the researcher attempted to conduct an evaluation of the current system while maintaining a clear view as a stakeholder. The evaluator of this study attempted to remain neutral when answering the survey questions in an effort to provide constructive feedback to improve the SLBT program for the institution.

### Study Population

#### *Sample*

In order to receive a holistic feedback from all stakeholders, the target population included all nursing students (n=185) who were currently enrolled in the Nursing Department at ADU, all nursing faculty (n=17) who were currently teaching in the undergraduate nursing program at ADU, and two technology support personnel (n=2) who have been supporting the SLBT program since 2009.

#### *Setting*

This evaluation study was conducted on the site of the ADU campus, which is located in downtown Orlando in the State of Florida, United States. ADU is a healthcare field focused university with about 3000 students. In terms of demographics of current students in the Nursing Department, 51% of them were identified as Caucasian American, 24% identified as Hispanic

American, 20% as African American, and 6% as Asian American. The average age of the nursing students was 33.

Data on the last six years' (from 2007 to 2013) NCLEX-RN passing rate were obtained by the evaluator from the Nursing Department at ADU in spring 2014. The SLBT program was first implemented in spring 2009 and the first cohort graduated at the end of spring 2010 (Figure 4). NCLEX-RN first-time passing rates from spring 2007 to spring 2010 were from the nursing students who were only exposed to the paper-and-pencil testing during their entire nursing program study at ADU; NCLEX-RN first-time passing rate from summer 2010 to summer 2013 were from the nursing students who were exposed to the SLBT program at ADU.

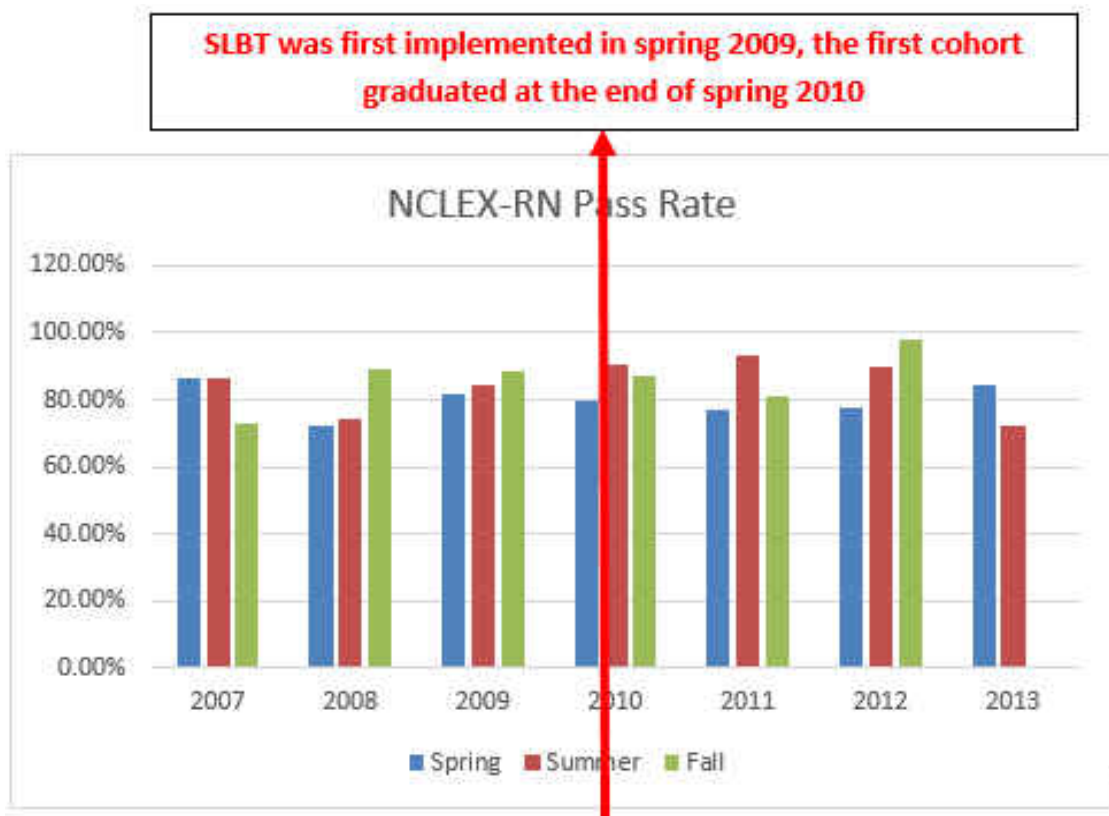


Figure 4: First-time NCLEX-RN Passing Rate Trend

## Instruments

The qualitative data collection took place by using open-ended questions in the surveys. These open-end questions were in essay format aiming to collect concrete feedback from students, faculty and technology support personnel. The quantitative data collection took place by using the Likert-scale questions (ranked from 1 to 5, with 1 being strongly disagree and 5 being strongly agree) in the surveys. All nursing students, nursing faculty, and technology personnel received verbal explanation from the evaluator outlining the general purpose of the study. The evaluation proposal was given approval from the IRB office at the University of Central Florida (see Appendix A) and it was also given approval from the ADU IRB office (see Appendix B). In order to maintain the anonymity of each participant, the evaluator chose the option in the university LMS system to “Not to show participants’ names” in the survey results. This caused the students, faculty and technology support personnel’ names not to appear on the response once their surveys were submitted.

The survey instrument administered to nursing students was piloted in the evaluator’s earlier paper that was published in the *Journal of Computers, Informatics, Nursing* in 2012 (Tao et al., 2012). The survey questions were designed based upon the SLBT program objectives so that objective-based evaluation approach could be utilized. The faculty and technology support personnel survey instruments (see Appendix D and Appendix E) were newly designed based on the objectives of the SLBT program, and the two instruments followed the same format as the student survey instrument. The main objectives of the SLBT program were: 1) present all tests on students’ laptops in a secure way where students can only engage in testing activities; 2) by taking exams on their laptops, students are becoming used to computerized testing, which will help them better prepare for their future National Council Licensure Examination for Registered



Nurses (NCLEX-RN); and 3) reducing faculty's workload related to test preparation, test question management, test administration, test re-grading, and test reviewing. The questions on the perceptions surveys were written with the goal of seeking feedback on those three program objectives.

First-time passing rate of NCLEX-RN three years before and three years after the implementation of SLBT program were obtained from the Nursing Department at ADU. Chi-Square procedure was performed using SPSS to see if there was any significant association between the type of testing methods and whether or not students would pass NCLEX-RN exam the first time.

#### Data Collection

The students' perception survey (See Appendix C) was managed and hosted in the Angel Learning Management System (Angel LMS) where all nursing courses were also hosted. Students (n=166) accessed the survey by logging into their Angel courses. The evaluator worked with the nursing faculty to make sure students know the goal of the survey and also to encourage them to complete the survey. Quantitative data were collected by the Angel LMS and were analyzed by calculating the mean score and the standard deviation from the Likert-scale questions (ranking from 1-5).

The seventeen nursing faculty who participated in this study were also surveyed via Angel LMS (See Appendix D) (n=17). Their perceptions of the SLBT program were assessed, recommendations were recorded, and themes were identified.

A third survey (See Appendix E) was administered via paper to the two technology support personnel (TSP) in their offices at the Center for Educational Technology. Their

perceptions of the SLBT program were also assessed, and their recommendations were recorded for the institution to consider.

### Data Analysis

For perception data from students, faculty, and technology support personnel, means and standard deviation on the Likert-scale (ranked from 1 to 5, with 1 being strongly disagree and 5 being strongly agree) questions were calculated to see how students, faculty, and support personnel perceive the SLBT program. For data on NCLEX-RN first-time passing rate, the Chi-Square test was performed to see if there was any significant association between the type of testing methods and the first-time passing rate of the NCLEX-RN exam.

### *Internal and External Validity*

Internal validity was weak in this study due to the fact that it was very difficult to contribute the passing rate change to one specific factor: the SLBT program. NCLEX-RN's first-time passing rate is associated with many factors, such as nursing students' scores on the Scholastic Aptitude Test (SAT) or the American College Test (ACT), students' performance in pre-nursing courses and selected nursing courses, the exam taker's age, gender, ethnicity, experience in healthcare field, and English as the primary language (Giddens & Gloeckner, 2005). The lack of manipulation of multiple variables can limit the researcher's ability to establish direct correlational relationship and can also limit the researcher's ability to generalize research findings to other similar settings (Fraenkel et al., 2012; Schenker & Rumrill, 2004).

External validity was not a concern because the evaluation findings were not intended to be generalized for other settings. The main goal of this evaluation study was to collect feedback from students, faculty, and technology support personnel in order to improve the current SLBT program at ADU. Other institutions, however, with similar settings (laptop initiative, wireless

campus, robust learning management system, and continuous support), can borrow many ideas from this study if they desire to implement computerized testing for their academic programs.

### *Data Analysis Methods*

Mean (ranked from 1 to 5, with 1 being strongly disagree and 5 being strongly agree) and standard deviation instruments were performed on the Likert-scale questions data from students, faculty, and technology support personnel. First-time NCLEX-RN passing rates three years before and after the implementation of the SLBT program were analyzed using the Chi-Square test via SPSS.

### Summary

The design used for this study was a mixed method evaluation study and it has the descriptive and correlational data elements. Descriptive evaluation was suitable in this study in determining whether program' performance was at the desired level. Correlational element was suitable in this study because the first-time passing rate of NCLEX-RN three years before and three years after the implementation of SLBT program were compared to see if there was any correlation between the two testing models (the conventional paper-and-pencil testing and the laptop-based secure testing) and the first-time passing rate of NCLEX-RN exam. One hundred sixty six nursing students (n=166) from the Nursing Department at ADU, seventeen nursing faculty (n=17), and two technology support personnel (n=2) participated in this study.

A learning management system (LMS)-based survey was the preferred method for data collection in this study due to its following advantages: 1) it was convenient - all students and faculty have access to the LMS where their courses were hosted; 2) it is free of cost to administer the survey within the LMS; 3) data collection is convenient to the evaluator as the LMS survey feature has mean and standard deviation calculation capabilities. Data were

collected by means of anonymous LMS-based surveys measuring students, faculty and technology support personnel' attitudes toward the SLBT program. The evaluator created the survey instruments using the survey feature within the LMS used by the ADU. This survey manager allowed for the data to be exported and provided the necessary security. Individuals were solicited to participate via verbal explanation on the purpose of the survey. All risks were clearly defined on the survey site, and participants were asked to confirm their eligibility to participate in their surveys.

## CHAPTER FOUR: ANALYSIS AND RESULTS

### Introduction

The purposes of this evaluation study were: 1) to seek constructive feedback from students, faculty, and technology support personnel on the secure laptop-based testing (SLBT) program; and 2) to investigate if there is a significant difference on students' first-time NCLEX-RN passing rate before and after the implementation of the SLBT program. This evaluation study was conducted during the time frame of fall 2013 to spring 2014 at the Adventist University of Health Sciences (ADU) campus, and the study sample consisted of 166 undergraduate nursing students, 17 nursing faculty, and two technology support personnel. Quantitative data of means and standard deviation were calculated on the data from the Likert-scale questions (ranking from 1 to 5) out of the perception survey of the students, faculty, and technology support personnel. Qualitative data from open-ended questions from those surveys were also collected and analyzed. The first-time NCLEX-RN passing rate data within the State of Florida three years before and three years after the implementation of the SLBT program were analyzed by SPSS.

### Study Design

The design used for this study was a mixed method evaluation study that had both descriptive and correlational data elements. Descriptive evaluation was suitable in this study in determining whether the SLBT program performance was at the desired level. Correlational elements were suitable in this study because the first-time passing rate of NCLEX-RN three years before and three years after the implementation of SLBT program were compared to see if there was any correlation between the two testing methods (the laptop-based secure testing and the conventional paper-and-pencil testing) and the first-time passing rate of NCLEX-RN exam.

One hundred sixty six nursing students (n=166) from the Nursing Department at ADU, 17 nursing faculty (n=17), and two technology support personnel (n=2) participated in this study.

The evaluation study mainly answered the following two evaluation questions:

- How is the SLBT program perceived by students, faculty, and technology support personnel?
- Looking at the first-time passing rate of the NCLEX-RN exam, is there any difference before and after the implementation of the SLBT program?

### Demographic Data

This evaluation study used three purposive samples: a sample of nursing students enrolled in the undergraduate nursing program (n=166) in the spring 2014 trimester at ADU; a sample of teaching nursing faculty (n=17) from the Nursing Department at ADU; and a sample of technology support personnel (n=2) from the Center for Educational Technology (CET) Department at ADU.

In terms of demographics of nursing students in the Nursing Department, the following data were obtained by the evaluator from ADU in the spring 2014 trimester: 51% of them were identified as Caucasian American, 24% identified as Hispanic American, 20% as African American, 4% as Asian American, and 1% as others (see Figure 5).

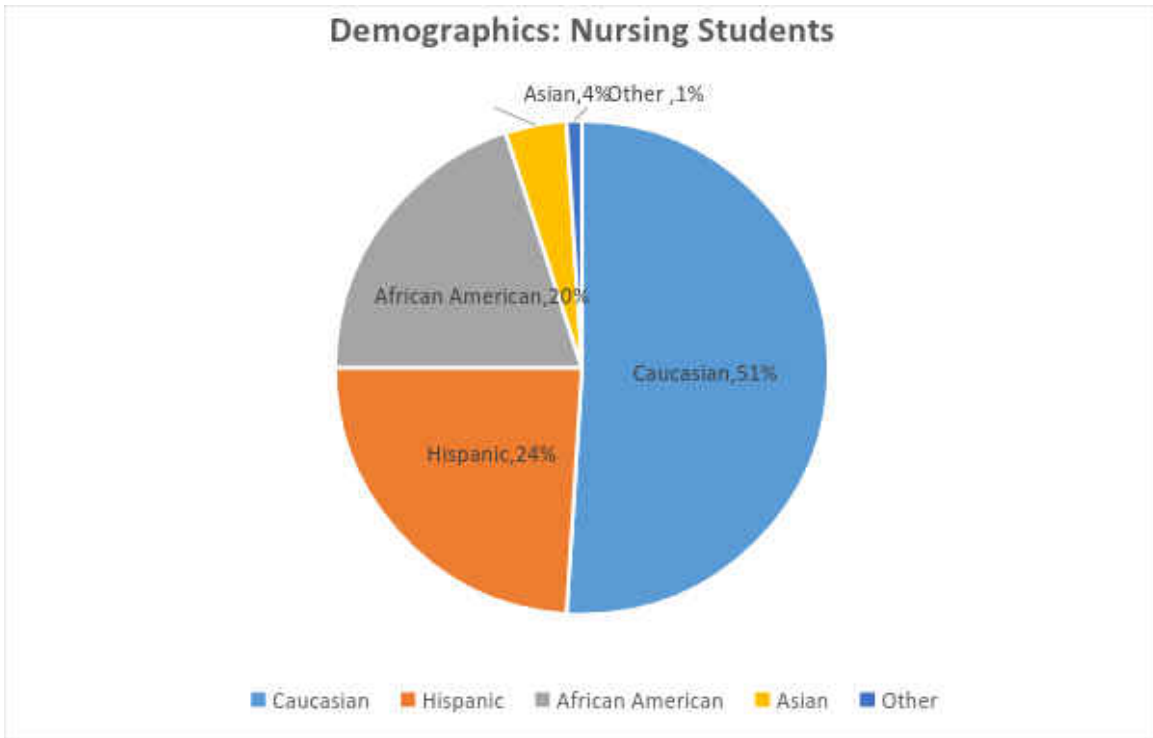


Figure 5: Demographics of Nursing Students at ADU

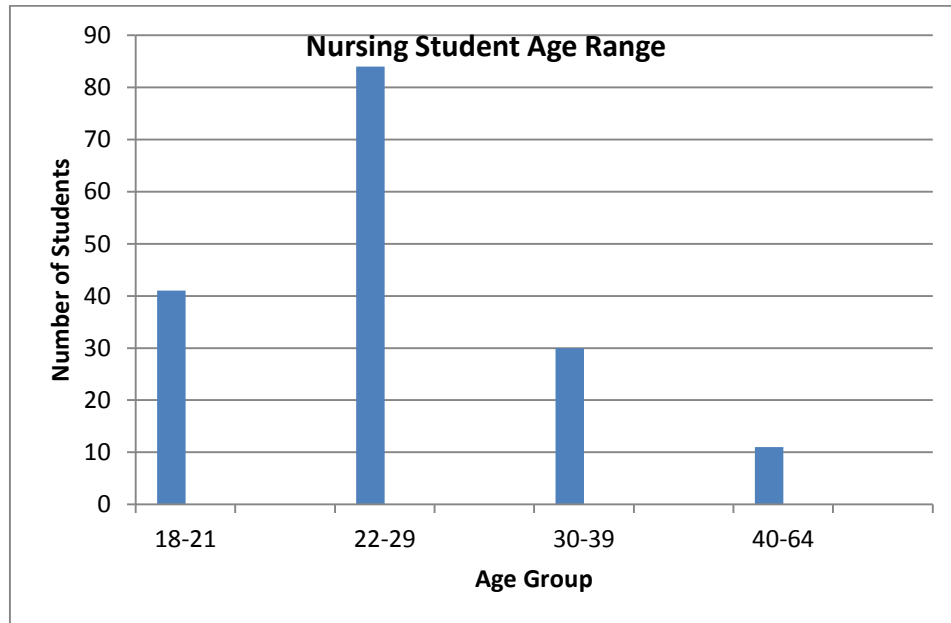
The nursing student sample consisted of 12 males and 154 females (see Table 4).

Table 4

Descriptive Statistics for Nursing Student Gender

<i>Gender</i>	<b>Enrolled</b>	<b>%</b>
<i>Male</i>	12	7
<i>Female</i>	154	93
<i>Total</i>	166	100

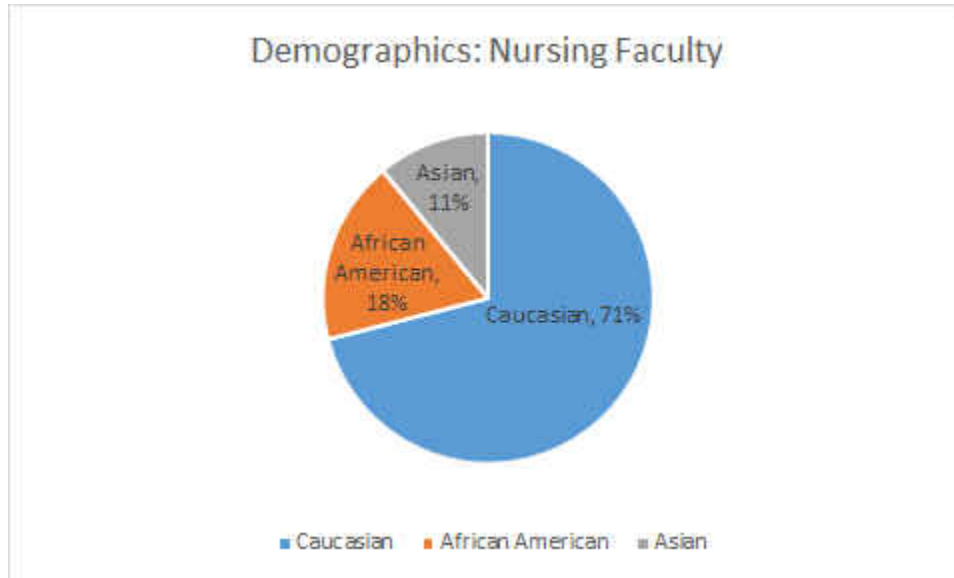
The data for four age groups and the number of students in each group are reflected in Figure 6. The oldest was 64 and the youngest was 18, therefore the range of age was 46. The average age of the nursing students sample was 27.



*Figure 6: Nursing Student Age Range Distribution at ADU*

For the nursing faculty who participated in this study, 71% identified themselves as Caucasian Americans, 18% identified themselves as African Americans, and 11% identified themselves as Asian Americans. For the technology support personnel, one was identified as Caucasian and one was identified as Asian. See Figure 7.





*Figure 7: Demographics of Nursing Faculty at ADU*

The nursing faculty sample consisted of 17 full-time employees from the Nursing Department at ADU. The sample was dominated by female faculty (94%). See Table 5.

Table 5

Descriptive Statistics for Nursing Faculty Gender

<i>Gender</i>	<b>Full-time Faculty</b>	<b>%</b>
<i>Male</i>	1	6
<i>Female</i>	16	94
<i>Total</i>	17	100

### Students Perception Data Analysis

All 185 of the students (population) from the Nursing Department were given the piloted survey instrument (see Appendix C) to collect their feedback; the survey was hosted in the university's Angel learning management system (Angel LMS). One hundred sixty six students (n=166) returned the survey, and the return rate was 90%. Thus, the sample of the nursing students of this study was 166. The survey instrument had four Likert-scale questions (ranked from 1 to 5, with 1 being strongly disagree and 5 being strongly agree) and two open-ended questions aiming for qualitative feedback. The evaluator requested course faculty to set up a time when students brought their laptops to the class to complete the survey. On the day of survey administration, the evaluator went to the classrooms to meet the students, explained the background and goals of the survey, and asked students to log into the Angel LMS to complete their survey. Since the four questions were on Likert-scale, the Angel LMS's survey feature was able to perform the means and standard deviation calculations of the students' perception survey data (see Table 6).

Survey questions 1 to 3 were designed to gauge students' perception on their computerized testing experience, NCLEX-RN preparation, and technology support satisfaction. Students' perception mean score to the survey question 1, 2, and 3 ranged from 3.8 to 4, with "1" being the strongly disagree and "5" being the strongly agree. With respect to percentage, the majority of students (ranged from 70% to 81%) surveyed agreed (on all the "agree areas" on the Likert scale) those three statements: 1) the SLBT program provided them an interactive experience on taking exams on the computer; 2) the SLBT program helps them better prepare for the future computerized NCLEX-RN; and 3) most laptop glitches happened during computerized

testing could be resolved by the technology support people on a timely manner.

Table 6

Student Perception Survey Quantitative Data

Likert-Scale Survey Questions	Mean	1	2	3	4	5
1. The Secure Laptop-based Testing (SLBT) program provides me an interactive experience on taking exams on the computer.	3.8	4%	6%	20%	44%	26%
2. I believe the SLBT program helps me better prepare for the future National Council Licensure Examination for Registered Nurses (NCLEX-RN), which is also computerized.	4.0	5%	2%	12%	48%	33%
3. If glitches happen during a computerized test, the technology support people resolve them quickly.	3.9	0	4%	24%	55%	17%
4. Overall I like and am satisfied with the SLBT program.	3.3	3%	23%	21%	52%	1%
<b>Note. Strongly Disagree=1; Disagree=2; Unsure=3; Agree=4; Strongly Agree=5</b>						

Survey question 4 was designed to measure students’ perception on their overall satisfaction of the SLBT program. Students’ perception mean score was 3.3 (M=3.3, SD=0.95). With respect to percentage, 53% of the students surveyed agreed (on all the “agree areas” on the Likert scale) that they were satisfied with the SLBT program. Among this 53% of students, only 1% of them “strongly agreed” that they were satisfied with the SLBT program. The finding indicated that approximately 21% of the students were not sure about the SLBT program and 26% of the students expressed their dissatisfaction with the SLBT program.

Qualitative data collected from the two open-ended questions at the end of the student survey. See Table 7 for the results of the qualitative data collected for question 1, which was: Besides taking exams, what else are students using the laptop for? See Table 8 for the results of the qualitative data collected for question 2, which was: If you change the SLBT program, what would be your recommendations?

Table 7

Student Perception Survey Qualitative Data (1)

Open-ended Question 1: Besides taking exams, what else are students using the laptop for?	
School Related	Non-school Related
<ul style="list-style-type: none"> <li>● Do homework such as writing papers, design PowerPoints, conduct online quizzes, do case studies, and use Excel</li> <li>● Watch online multimedia lectures</li> <li>● Email my professors in Angel LMS</li> <li>● Reading e-textbooks</li> <li>● Take notes in class</li> <li>● Use laptop to record classroom live lectures</li> <li>● Use laptop-based virtual clickers to do polling in class</li> </ul>	<ul style="list-style-type: none"> <li>● Use recreationally such as watching DVDs and YouTube</li> <li>● Go on Facebook or other social media networks such as Twitter</li> <li>● Browse online</li> <li>● Shopping online</li> <li>● Listen to music</li> <li>● Read online news</li> <li>● Skype with my friends</li> </ul>

For the first open-ended question “Besides taking exams, what else are students using the laptop for” (Table 7), students’ feedback was categorized into two major categories: school related activities and non-school related activities. For the school-related activities, data revealed that most students were using their laptops to do homework, watch online pre-recorded lectures, and read e-textbooks. For the data on non-school related activities, many students used their laptops to browse online for news, watch DVDs, and engage in social networks such as Facebook and Twitter to communicate with their friends.

For the second open-ended question on the student survey (Table 8), students' feedback was divided into two major categories: positive comments and negative comments. This information was summarized in Table 8. For the positive comments, "SLBT Benefits" was the overarching theme emerged from students' feedback. This overarching theme was further categorized into two sub themes: 1) NCLEX-RN simulation and 2) other SLBT benefits. For the SLBT program's effort to simulate the NCLEX-RN testing environment, students praised the SLBT program for giving them hands-on experience on taking exams or quizzes on the computer, thus they felt better prepared for the future computerized NCLEX-RN exam. They were also satisfied with the technology support when their laptops had glitches during testing. For the specific benefits of the SLBT program, students enjoyed the immediate grade reporting and individualized test reviewing. Students also used their laptops for other school related activities such as doing homework and listening to online pre-recorded lectures.

For the negative comments, "technology issues" was the overarching theme emerged from students' feedback. This overarching theme was further categorized into four sub themes: 1) laptops glitches- laptops often running sluggish, windows having too many frequent updates that can be interruptive during testing, laptops being vulnerable to computer viruses, laptops being too heavy, and laptops being too expensive for many students; 2) unstable university wireless network - students' exams being erased due to loss of connectivity during testing, and sluggishness of retrieving a new question during testing; 3) unstable Angel LMS - exams being postponed due to Angel LMS system failure and the calculator inside the testing browser being too slow to show up at times; and 4) inadequate technology support - the resolution process being too time consuming when there are hardware problems with the laptops and lack of Mac computer support.

Table 8

Student Perception Survey Qualitative Data (2)

Open-ended question 2: If you change the SLBT program, what would be your recommendations?	
Positive Comments ( <b>SLBT Benefits</b> )	Negative Comments ( <b>Tech Issues</b> )
<p><b>Sub Theme 1: NCLEX-RN Simulation</b></p> <ul style="list-style-type: none"> <li>● The (SLBT) program works well so far! It lets me practice NCLEX style questions</li> <li>● Overall it is a fine program; especially it simulates the NCLEX-RN test</li> <li>● I feel more prepared for the NCLEX-RN exam because of the SLBT program</li> <li>● Coming to this school was my first time to take tests on computers. It took time to get used to it but I found it very useful because NCLEX-RN is on the computer too.</li> </ul> <p><b>Sub Theme 2: Other SLBT Benefits</b></p> <ul style="list-style-type: none"> <li>● I use my laptop for everything: testing, homework, online lecture, music, and pictures</li> <li>● I get to see my grades right after I click on the submit button on the tests!</li> <li>● Test review is right on my own laptop so I can go to my own tests to see which I miss</li> <li>● I was relieved that even when my laptop had shut down on me in the middle of taking an online exam, the program (SLBT) lets me go back to the question where I had left off</li> <li>● I like the SLBT program. It has given me problems a few times but the staff was there to help me</li> <li>● Tech support is very helpful and always present at the beginning of class</li> </ul>	<p><b>Sub Theme 1: Laptop Glitches</b></p> <ul style="list-style-type: none"> <li>● I have experienced many glitches. My laptop runs slow almost all the time</li> <li>● The PC laptop has too many updates and a lot of security issues</li> <li>● The laptop is too heavy for me to carry considering I have so many books to carry already</li> <li>● The laptop is too expensive but the quality is so poor!</li> <li>● Don't like to be forced to buy a poor-quality laptop from the school</li> </ul> <p><b>Sub Theme 2: Unstable Wireless Network</b></p> <ul style="list-style-type: none"> <li>● Sometimes it takes some time for each question to load and sometimes it glitches and has to be refreshed</li> <li>● My answers got erased one time and I had to retake the test</li> <li>● Sometimes we have Internet connectivity issue during the testing. The network is slow sometimes</li> </ul> <p><b>Sub Theme 3: Unstable Angel LMS</b></p> <ul style="list-style-type: none"> <li>● Angel (LMS) was down a few times and we had to wait until it was fully back up before taking our exams</li> <li>● Sometimes I can't log into Angel to see my grades</li> <li>● The calculator inside the lockdown browser is too slow and not very reactive.</li> </ul> <p><b>Sub Theme 4: Inadequate Tech Support</b></p> <ul style="list-style-type: none"> <li>● When my laptop had hardware issues, the problem resolution process was too time consuming</li> <li>● Offer support for Mac computers</li> </ul>

### Technology Support Personnel Perception Data Analysis

The two technology support personnel (TSP) from the Center for Educational Technology (CET) Department at ADU have been supporting the SLBT program since 2009. This evaluation study was an internal evaluation and the evaluator himself was one of the two TSP. Internal evaluators typically know more about the program, the organization, and policy-makers' decision making style. Therefore, internal evaluators can provide valuable and formative evaluation for program improvement (Lambur, 2008). On the other hand, internal evaluators' most obvious disadvantage is the potential bias toward the program they are evaluating. The evaluator himself also participated in the technology support personnel perception survey (see Appendix E) and the evaluator had strong opinions and substantial knowledge toward the SLBT program, therefore the evaluator and researcher might be willing to spend more time answering the survey or tend to give most favorable answers on the survey questions. This study notes that researcher bias may have played a significant part in this segment of the evaluation process. Research bias can be defined as any propensity, which suggest prejudiced to questions asked, however, the researcher attempted to conduct an evaluation of the current system while maintaining a clear view as a stakeholder. The researcher and evaluator of this study attempted to remain neutral when answering the survey questions (see Appendix E) in an effort to provide constructive feedback to improve the SLBT program for the institution.

The survey consisted four Likert-scale question statements and two open-ended questions. Table 9 recorded students' quantitative responses to the four survey statements and Table 10 recorded students' qualitative responses to the two open-ended questions.

Table 9

## Technology Support Personnel Perception Survey Quantitative Data

Survey Questions	Mean	1	2	3	4	5
1. Generally, if glitches happen during a computerized test, I can resolve them right in the testing classroom.	5	0	0	0	0	100%
2. Generally, if glitches happen during a computerized test, I can get them resolved very quickly.	4.5	0	0	0	50%	50%
3. I believe the Secure Laptop-based Testing (SLBT) program will help students better prepare for their future National Council Licensure Examination for Registered Nurses (NCLEX-RN), which is also computerized.	5	0	0	0	0	100%
4. Overall I believe this Secure Laptop-based Testing (SLBT) program works well.	5	0	0	0	0	100%
<b>* Strongly Disagree=1; Disagree=2; Unsure=3; Agree=4; Strongly Agree=5</b>						

The TSP's perception mean score to survey question 1, 2, 3, and 4 ranged from 4.5 to 5, with 1 being the strongly disagree and 5 being the strongly agree. It indicated that the two TSP could fix most laptop related glitches right in the classroom for students; it confirmed that the TSP were well-trained professionals to troubleshoot and fix most laptop related glitches for students on a timely manner; it also revealed that the two TSP were confident that the SLBT program would better prepare students for their future computerized NCLEX-RN exam; and lastly, it showed TSP were totally satisfied with the SLBT program

Qualitative data were collected from the two open-ended questions at the end of the TSP perception survey (see Appendix E):



- 1) If I can't troubleshoot laptop glitches on a timely manner, what are my backup plans?
- 2) If I could change the secure laptop-based testing (SLBT) program, here are my recommendations: (see Table 10)

Table 10

Technology Support Personnel Perception Survey Qualitative Data

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**Open-ended Question 1: If I can't troubleshoot glitches on a timely manner, what are my backup plans?**

- Depends on the problems I encounter, if student's laptop has serious issues, I give him or her a loaner laptop on the spot (I bring a loaner laptop with me every time when I go to the classroom to support); if it is due to the Internet network issues, I may need to work with the faculty to extend the testing time.
- If I can't fix the glitch on the spot quickly, students can go to the university library to get a loaner laptop to continue their tests.

**Open-ended Question 2: If I could change the Secure Laptop-based Testing (SLBT) program, here are my recommendations:**

- The university needs to select better quality laptops for students if the laptop initiative program continues.
  - The university may have to think about the open-laptop option where students bring their own computers to campus for testing.
- 

For the first open-ended question, if the TSP couldn't troubleshoot laptop glitches on a timely manner, there were two options: 1) give a fully equipped loaner laptop to the student who is having glitches (the TSP typically bring a fully equipped loaner laptop to the classroom before tests begin); and 2) students could go to the library to get fully equipped loaner laptops (the university library stored and maintained a dozen loaner laptops for students). For the second open-ended question, the two TSP gave out their recommendations for the institution to consider: 1) the Nursing Department needs to choose better quality laptops for students if the laptop

initiative program continues; and 2) the university may have to think about the open-laptop option if the university doesn't plan to continue the laptop initiative program.

### Nursing Faculty Perception Data Analysis

Seventeen full-time nursing faculty from the Nursing Department participated in this study. The evaluator used the survey feature in ADU's Angel learning management system (Angel LMS) to host the nursing faculty perception survey (see Appendix D). The evaluator went to each nursing faculty's office, explained the background and goal of the survey, and guided each nursing faculty to log in Angel LMS to access the survey. All 17 nursing faculty completed and returned the perception survey (return rate 100%). Eight Likert-scale (ranking from 1-5, with 1 being the strongly disagree and 5 being the strongly agree) questions and one open-ended question were used to assess their perceptions on the SLBT program. Means and standard deviation were calculated from the quantitative data obtained from the eight Likert-scale questions in the following Table 11.

In response to the survey question 1, 2, 3, 4, 7, and 8, faculty's perception mean score ranged from 4.5 to 4.8, with 1 being the strongly disagree and 5 being the strongly agree. All (100%) faculty agreed (on all the "agree areas" on the Likert scale) those six statements: 1) compared with the paper-and-pencil method, the SLBT program reduced their workload; 2) Test administration, test re-grading, and test reviewing were manageable in SLBT; 3) the SLBT successfully simulated most the questions formats (such as multiple-choice, multiple-select, matching, ordering, and fill-in-the-blanks) that appear on the NCLEX-RN exam; 4) the SLBT program helped nursing students better prepare for their NCLEX-RN exams; 5) they were satisfied with the support from the Center for Educational Technology Department; and finally, 6) they were satisfied with the SLBT program.

In response to the survey question 5, faculty's perception mean score is 4.4 (M=4.4, SD=0.6). Ninety four percent of faculty agreed (on all the "agree areas" on the Likert scale) that the SLBT program delivered secure tests to students, with 47% of them "strongly agreed" with this statement. Many faculty believed that the number of students' cheating activities during nursing exams has been decreased since the SLBT program was implemented in 2009, compared with the previous paper-and-pencil testing method.

In response to the survey question 6, faculty's perception mean score is 4.1 (M=4.1, SD=0.94). Eighty two percent of nursing faculty agreed (on all the "agree areas" on the Likert scale) that the laptop glitches are manageable during testing, while the other 18% had concerns on laptop glitches, campus wireless Internet glitches, and Angel LMS glitches during testing.

Table 11

## Faculty Perception Survey Quantitative Data

Survey Questions	Mean	1	2	3	4	5
1. Compared with paper-and-pencil testing, the Secure Laptop-based Testing (SLBT) program reduces my workload related to testing.	4.7	0	0	0	29%	71%
2. Compared with paper-and-pencil testing, administering, re-grading, and reviewing the computerized tests are more manageable for me.	4.5	0	0	0	47%	53%
3. The SLBT program simulates most of the question formats that appear on the National Council Licensure Examination for Registered Nurses (NCLEX-RN).	4.6	0	0	0	41%	59%
4. I believe the SLBT program helps students better prepare for their future NCLEX-RN, which is also computerized.	4.8	0	0	0	23%	77%
5. Overall, I believe laptop-based testing is secure.	4.4	0	0	6%	47%	47%
6. Overall, laptop glitches are manageable for students during computerized exams.	4.1	0	12%	6%	47%	35%
7. I am satisfied with the technology support I receive from the SLBT program.	4.6	0	0	0	35%	65%
8. Overall, I am satisfied with the SLBT program.	4.6	0	0	0	41%	59%
<b>Note: Strongly Disagree=1; Disagree=2; Unsure=3; Agree=4; Strongly Agree=5</b>						

Qualitative data was collected from the faculty with one open-ended question on the survey (see Appendix D). This open-ended question was the last question of the faculty survey instrument and Table 12 recorded the requested recommendations for the SLBT program from the faculty's perspective. Faculty's recommendations on the SLBT program were categorized into two overarching themes: technology issues and praises for SLBT program. The technology issues were further categorized into four sub categories: laptop related, wireless network related, LMS related, and support related. In terms of sub category A "laptop related", they recommended better quality laptops for students if the Nursing Department decided to continue the laptop initiative program. They also recommended allowing Mac computers to be used for testing. In terms of sub category B "campus wireless Internet network related", they recommended to further stabilize the campus wireless network during testing times, and they also recommended having a backup wireless network system so that the SLBT program could continue when the main campus network system were having glitches. In terms of sub category C "LMS related", they recommended the university to work with the LMS vendor to have more NCLEX-RN test question types such as "auditory" or "hot-spot" question formats. In terms of sub category D "support related", they recommended to increase the support level, because at times, when three or four nursing exams were on-going at the same time, the Center for Educational Technology Department (CET) was short-staffed for the technology support.

The second overarching theme of faculty's qualitative feedback was very obvious: they praised the SLBT program. Overall, the nursing faculty were very satisfied with the SLBT program because the glitches during testing were manageable, the SLBT testing was secure, the SLBT program has reduced their workload related to testing, and they were very satisfied with the CET's technology support service.

Table 12

Faculty Perception Survey Qualitative Data

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Open-ended Question: If I could change the Secure Laptop Testing (SLBT) program, here are my recommendations:

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***Overarching Theme 1: Technology (Tech) Issues***

*Tech Issue A: Laptop Related*

- Help students set up the automatic Windows update so it doesn't interrupt test.
- Make the program (SLBT) work with all types of laptop computers including the Mac computers.
- Students get very distracted by laptop glitches. Choose better quality laptops for them!

*Tech Issue B: Wireless Internet Network Related*

- When campus wireless Internet network has problems, it causes students to lose testing time and it is difficult at the end of the exam to give students time back that is lost.
- At times the Internet network crashes and it would be great if there was a backup system that we do not have to wait for it to back up to start our exams.

*Tech Issue C: LMS Related*

- Add the "point and click" and "auditory" questions formats for exam questions.
- Allow the LMS administrator to stop the clock on an exam while a glitch is being addressed.

*Tech Issue D: Support Related*

- The most important thing for the program (SLBT) is to see students or support staff is able to resolve the technical issues on a timely manner.
- More staff support, to have a person at every testing time and classroom location.

***Overarching Theme 2: Praises for SLBT***

- I wouldn't change a thing on the program (SLBT)! A few glitches are manageable!
  - Cheating was reduced due to question order randomization and the lockdown browser!
  - I am very happy about the program (SLBT), and now I spend less time on test preparation, and it makes my work more efficient!
  - The support staff is excellent! They are knowledgeable, supportive, and always available.
-

### NCLEX-RN Passing Rate Data Analysis

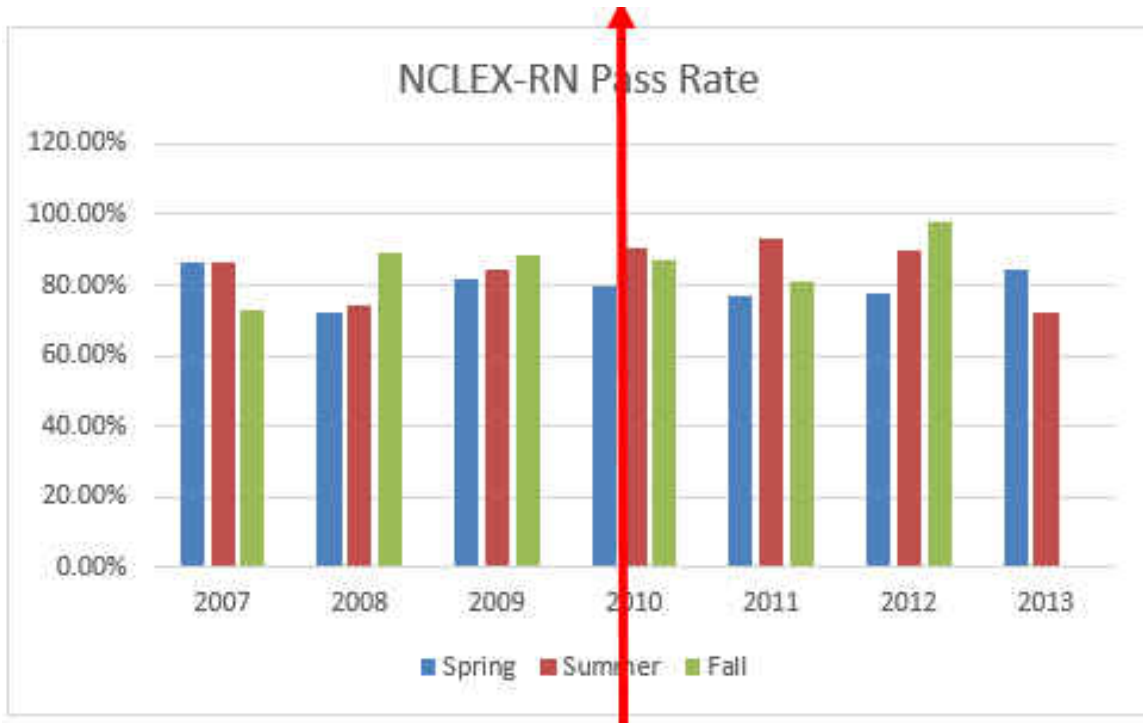
The first-time NCLEX-RN passing rate data within the State of Florida was obtained by the evaluator from the Nursing Department with the university administration's permission (see Appendix G). The passing rate data from 2007 to 2013 were organized into the following Table 13.

Table 13

First-time NCLEX-RN Passing Rate Data

	2007	2008	2009	2010	2011	2012	2013
Spring	86.49%	72.22%	81.67%	79.48%	76.90%	77.58%	84.13%
Summer	86.36%	74.24%	84.61%	90.24%	93.02%	90.00%	72.13%
Fall	72.92%	89.47%	88.37%	86.96%	80.77%	98.21%	

The SLBT program was first implemented in spring 2009 and the first cohorts who were exposed to the SLBT program graduated at the end of spring 2010. Therefore, from spring 2007 to spring 2010, the first-time passing rate data of NCLEX-RN came from the nursing graduates who were only exposed to paper-and-pencil testing during their entire nursing program at ADU. From summer 2010 to summer 2013, the first-time passing rate data of NCLEX-RN came from the nursing graduates who were exposed to the SLBT program during their entire nursing program at ADU. To better present the passing rate data, Table 13 was converted to the following column chart (Figure 8).



*Figure 8: NCLEX-RN Passing Rate (2007-2013)*

The Nursing Department at ADU only kept the first-time passing rate data for its nursing graduates who took their NCLEX-RN exam in the State of Florida. In the past, according to the Nursing Department, about 20% of the nursing graduates took the NCLEX-RN exam outside of State of Florida. Therefore, the first-time passing rate data of NCLEX-RN didn't represent the whole graduate nursing student body at ADU; rather, it only represented about 80% of the entire nursing student body. Looking at the Figure 8, it seems the overall passing rate is about the same before and after the implementation of the SLBT program. To have an accurate report of the difference, a Chi-Square test was performed to see if there is any significant relationship between the two testing methods and the first-time NCLEX-RN passing rate. Based on the Appendix G, the actual number of ADU graduate nursing students who took the NCLEX-RN exam in the



State of Florida over the six-year period (2007-2013) were re-organized and presented for SPSS analysis (see Table 14).

Table 14

Testing Strategy Data

First-Time Passing	Traditional Method	SLBT <sup>b</sup>	Total
NCLEX-RN <sup>a</sup>			
Yes	378	430	808
No	93	77	170
Total	471	507	978

<sup>a</sup> National Council Licensure Examination for Registered Nurses    <sup>b</sup> Secure Laptop-based Testing

From spring 2007 to spring 2010, there were 471 graduate nursing students that took the NCLEX-RN in the State of Florida; and among them, 378 passed the NCLEX-RN at the first attempt and 93 students didn't pass the first time. From summer 2010 to summer 2013, 507 graduate nursing students from ADU took the NCLEX-RN exam in Florida; and 430 of them passed the first time with 77 failing the first attempt. The total number of ADU nursing students who took the NCLEX-RN exam in Florida over the six-year period (2007-2013) was 978, which was about 80% of the total ADU graduate nursing students; the other 20% of ADU graduate nursing students took the NCLEX-RN exam outside the State of Florida, and the Nursing Department didn't have these students' first-time passing rate data. A Chi-Square test (Table 15) was performed by using SPSS.

Table 15

Chi-Square Test

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.532 <sup>a</sup>	1	.060	.064	.036
Continuity Correction <sup>b</sup>	3.222	1	.073		
Likelihood Ratio	3.532	1	.060	.064	.036
Fisher's Exact Test				.064	.036
N of Valid Cases	978				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 81.87.

b. Computed only for a 2x2 table

The complete SPSS output for the Chi-Square test can be found in Appendix H. There was no significant association between the type of testing methods and whether or not students would pass the NCLEX-RN exam the first time  $X^2(1) = 3.53, p > .05$ . Since the Chi-Square significant value was 0.06, which was very close to 0.05, effect size (see Appendix H) was also calculated via SPSS. It seems that, with the traditional paper-and-pencil testing method, the odds for students to pass the NCLEX-RN exam the first time was 4.06; the odds for students to pass the NCLEX-RN exam with the SLBT program exposure was 5.58; therefore, based on the odds ratio, the odds for students to pass NCLEX-RN at first time were 1.37 times higher if they were taught with the SLBT testing method than if taught with the traditional paper-and-pencil testing method.

## Summary

This study was conducted between the fall semester of 2013 and the spring semester of 2014 at the ADU campus. The study sample consisted of 166 undergraduate nursing students, 17 nursing faculty, and two technology support personnel. The purposes of this study were: 1) to seek constructive feedback from students, faculty, and technology support personnel on the SLBT program; and 2) to see if there is a significant difference on students' first-time NCLEX-RN passing rate before and after the implementation of the SLBT program. Means and standard deviation were calculated on the quantitative data via Likert-scale questions on the three perception surveys from students, faculty, and technology support personnel. Qualitative data on open-ended questions from the three surveys also collected, and themes were analyzed and emerged. Overall, students had a positive experience with the SLBT program, but many of them had a lot of concerns on the laptop glitches and campus wireless Internet network glitches they were experiencing during testing. Faculty and technology support personnel, on the other hand, were very satisfied with the SLBT program, and they firmly believed the SLBT program would help nursing students better prepare the future computerized NCLEX-RN exam.

The first-time NCLEX-RN passing rate data from 2007 to 2013 within the State of Florida were analyzed by SPSS. There was no significant association between the two types of testing method and whether or not students would pass the NCLEX-RN exam the first time  $X^2(1) = 3.53, p > .05$ ; however, the odds for students to pass the NCLEX-RN the first time were 1.37 times higher if they were exposed with the SLBT program during their nursing program than if exposed with the traditional paper-and-pencil testing method during their nursing program.

## CHAPTER FIVE: DISCUSSION AND CONCLUSIONS

### Introduction

Chapter five presents a discussion of the results of the data analysis presented in chapter four, and it also gives out recommendations for the Nursing Department and the administration of Adventist University of Health Sciences (ADU). The main purpose of this study was to seek constructive feedback from students, faculty, and technology support personnel on the secure laptop-based testing (SLBT) program. In addition, the evaluator was interested to see if there was a significant difference on students' first-time National Council Licensure Examination for Registered Nurse (NCLEX-RN) passing rate before and after the implementation of the SLBT program.

This evaluation study used quantitative and qualitative data from the three major stakeholders: nursing students (n=166), nursing faculty (n=17), and technology support personnel (n=2). The evaluator piloted the student survey instrument used in an earlier study in 2012 (Tao, Lorentz, Hawes, Rugless, & Preston, 2012). The survey instruments for faculty and technology support personnel followed the same format as the student survey instrument and the evaluator based on the objectives of the SLBT program newly designed for them. The first-time NCLEX-RN passing rate data within the State of Florida was obtained by the evaluator from the Nursing Department at ADU.

### Discussion of Evaluation Question 1

Both quantitative and qualitative data collected in this study provided the organization the results needed to address the following SLBT program evaluation question 1: What are students, faculty, and technology support personnel's satisfaction level (1 to 5 scale with 1 being the

lowest and 5 being the highest) on the overall SLBT program? Students' mean score on the overall SLBT program satisfaction was 3.3 on a 5-point scale, which indicated they were "Okay" with the program, but many of them had concerns. Qualitative data analysis revealed two major themes: SLBT benefits and technology issues. Students enjoyed the benefits of the SLBT program such as it simulates the NCLEX-RN testing environment, it offers students and faculty instant scoring and feedback, and it allows students to conduct individualized test review. This confirmed prior research finding on the advantages of computerized testing: fast delivery, immediate scoring and feedback for both students and instructors, convenient test question re-grading and reviewing, and reduced human errors (Tippins et al., 2006; Niemeyer, 1999). At the same time, students were concerned about technology challenges they experienced during testing: laptop glitches, poor overall laptop quality, sluggish Angel LMS, and the university's unstable wireless Internet network. A recommendation list emerged from students' qualitative feedback:

- Allow us to bring in Mac (Macintosh) computers for testing.
- Offer Mac laptop support during testing.
- Allow us to bring our own laptops, instead of forcing us to purchase one from the school.
- Select a lighter laptop because the current laptop is too heavy for me to carry.
- We need more anti-virus support.
- Change the brand of the laptop to better ones such as Dell or HP.

The above recommendation list revealed two overarching suggestions from students: 1) allow students to bring their own laptops (PC or Mac computers) to campus for testing, instead of purchasing a new laptop from the university designated source; 2) if the university's laptop

initiative program continues, the university will need to provide better quality laptops for nursing students to purchase for testing.

Technology support personnel, on the other hand, had a mean score of 5 on a 5-point scale on the overall SLBT program satisfaction, which indicated they were very satisfied with the SLBT program. The researcher himself was one of the two technology support personnel who participated in the survey. This study notes that researcher bias may have played a significant part in this segment of the evaluation process. Research bias can be defined as any propensity which suggest prejudice to questions asked. The researcher, however, attempted to conduct an evaluation of the current system while maintaining a clear view as a stakeholder. The researcher attempted to remain neutral when answering the survey questions in an effort to provide constructive feedback to improve the SLBT program for the institution.

It seemed that the support load (10 undergraduate nursing courses with an average of five major exams per course) was manageable for the two full-time educational technologists. From their perspective, the overall SLBT program operated effectively with some consistent technological issues, which could be addressed with continuous support. Qualitative data from the technology support personnel revealed that, like students, the technology support people had two similar recommendations for the institution: 1) if the Laptop Initiative Program (LIP) continues, the university needs to choose better quality laptops for students to alleviate laptop glitches during testing; and 2) the university may need to re-evaluate the current LIP and move to an open-laptop environment where students bring their own devices to campus for testing.

Faculty's mean score on the overall SLBT program satisfaction was 4.6 on a 5-point scale, which indicated that they were very satisfied with the program. After some training and guidance, many faculty were able to prepare test questions, administer tests, and manage test

banks by themselves. Qualitative data from the faculty's feedback indicated they were very satisfied with the reduced testing workload, and they were very satisfied with the technology support from the Center for Educational Technology Department; however, they were concerned about issues such as laptop glitches, learning management system (LMS) downtime, and the unstable on-campus wireless network that caused interruption during testing. Thus, faculty were asking for more collaborations between the Center for Educational Technology Department and the Information Technology Department to further stabilize the campus wireless network and Angel LMS.

In summary, students liked the SLBT program but they didn't like the idea of purchasing a poor quality laptop and they were concerned about the technology glitches experienced during testing; whereas, technology support personnel and faculty were very satisfied with the SLBT program. This finding is significant to the Nursing Department and the ADU institution because the Laptop Initiative Program (LIP) was implemented since 2004, and it seems that nursing students have been complaining about the mandatory laptop purchase and various laptop, wireless network, and LMS related glitches for a long time. It seems that the university may need to re-evaluate the LIP and move to an open-laptop environment where students bring their own devices to campus for testing; if the institution decides to continue the LIP, however, the Nursing Department needs to work with the Information Technology Department and Center for Educational Technology Department to further stabilize campus wireless network, reduce LMS downtime, and choose better quality laptops for students to alleviate laptop, wireless network, and LMS related glitches during testing.

## Discussion of Evaluation Question 2

Both quantitative and qualitative data collected in this study provided the organization the results needed to address the SLBT program evaluation question 2: Does faculty believe that the SLBT program can simulate most of the question formats that appear on the National Council Licensure Examination for Registered Nurses (NCLEX-RN)?

Faculty's mean score was 4.6 on a 5-point scale, which indicated that they believed the SLBT program did simulate most of the question formats that appear on the NCLEX-RN exam. The university's learning management system was able to offer multiple-choice, matching, multiple-select, ordering, and fill-in-the-blank question formats that are the main types of question format on the recent NCLEX-RN exam. This finding confirms the prior research conclusion that computerized testing can broaden the range of knowledge-based assessments and testing methods (Bull & McKenna, 2000).

The exposure to NCLEX-RN style question formats will better prepare students for their future national board exam NCLEX-RN. This finding is significant because in the old paper-and-pencil testing model, nursing faculty were often limited to use the multiple-choice question format so that tests could be graded by Scantron machines and thus students didn't have exposure on other question formats such as multiple-select, matching, ordering, and fill-in-the-blanks, which often appear on the recent NCLEX-RN exam. The SLBT program has solved this issue by offering those multiple question formats to students so that they have hands-on experience of practicing those question formats off the computer screen. The SLBT program also simulates the NCLEX-RN testing environment where test questions were set as one question at a time without backtrack, test question order and answer options were both randomized, and the testing browser also has a simple calculator for students to use.



Faculty's qualitative feedback revealed that they were satisfied with the available question formats within the Angel LMS such as multiple-choice, fill-in-the-blanks, matching, ordering, and multiple-select; however, their feedback also indicated that Angel LMS didn't have "point and click" and "auditory" question formats, which recently began to appear on the computerized NCLEX-RN exam. This evaluation finding is valuable to the technology support personnel as they can work with the Angel LMS vendor to explore if those question formats can be added to the LMS system.

### Discussion of Evaluation Question 3

The quantitative data collected in this study provided the organization the results needed to address SLBT program evaluation question 3: Do students, faculty, and technology support personnel feel the SLBT program helps them better prepare for the National Council Licensure Examination for Registered Nurses (NCLEX-RN) which is also computerized?

Students' mean score was 4 on a 5-point scale, which indicated that most of the students believed the SLBT program helped them better prepare for the NCLEX-RN exam. Since all the tests and quizzes were administered on their laptops, students may be becoming accustomed to reading exam questions on the computer screen and using their keyboard and mouse to answer questions. The SLBT program has given students hands-on experience on taking tests on the computer (Tao et al., 2012). Many students left positive comments on the SLBT program in terms of simulating the NCLEX-RN testing environment, and they believed the hands-on practice would help them perform better on the NCLEX-RN. Students' feedback also showed that some students didn't feel comfortable taking exams on the computer at first, but with hands-on practice, they became used to it. Students were motivated to get themselves comfortable in the computerized testing environment during their nursing program because they knew the

NCLEX-RN was on the computer, and they have to pass it in order to become registered nurses. This confirmed the study finding from Halkitis and Leahy (1993) that it was important for nursing students to practice with computerized testing prior to taking the computerized NCLEX-RN.

Faculty and technology support personnel, on the other hand, had even higher mean scores: faculty being 4.8 on a 5-point scale and technology support personnel being 5 on a 5-point scale. This meant they firmly believed the SLBT program helped students better prepare for the NCLEX-RN. For example, in contrast to paper-and-pencil testing where students could go back to change their answers; in the SLBT program, tests were presented one question at a time with backtrack being disabled. Therefore, students couldn't go back to change their answers, which mirrored the NCLEX-RN exam style: one question at a time with no backtracks.

This finding assures the Nursing Department and the ADU institution that one of the SLBT goals was achieved: by taking exams on their laptops, students are exposed to computerized testing, which will help them on their future computerized NCLEX-RN exam. The institution needs this assurance in order to continue to provide adequate resources to implement the SLBT program in the long term.

#### Discussion of Evaluation Question 4

The quantitative data collected in this study provided the organization the results needed to address the SLBT program evaluation question 4: Does faculty feel the SLBT program helps them reduce the workload related to testing, compared with paper-and-pencil testing?

Faculty' mean score was 4.7 on a 5-point scale, which indicated that they believed the SLBT program helped them reduce workload related to testing, compared with the old paper-and-pencil testing format. This finding confirms the prior research conclusions that computerized

testing can reduce faculty's marking loads and can improve their administrative efficiency (Bull & McKenna, 2000). With the traditional paper-and-pencil testing, faculty spent more time on printing, grading (typically working with the Scantron machines), re-grading tests, and transferring grades into students' electronic gradebook. With the SLBT program, there was no need for test printing and grades transferring; furthermore, test grading and question re-grading could be done either automatically or with a few button pushes within the Angel LMS.

This finding is important because the SLBT program has saved faculty's time regarding testing administration and management and thus increased faculty's work productivity. Faculty had more time to engage in other meaningful teaching and learning activities. For example, faculty had more time at hand to think about more innovative ways to teach, or they could spend more time with students to help them learn challenging concepts. This finding also assures the Nursing Department and the ADU institution that the other SLBT goal was also achieved: the SLBT program reduces the faculty's workload related to test preparation, test question management, test administration, test re-grading, and test reviewing.

#### Discussion of Evaluation Question 5

The quantitative data collected in this study provided the organization the results needed to address the SLBT program evaluation question 5: Are administering, re-grading, and reviewing the exam manageable for nursing faculty?

The faculty's mean score was 4.5 on a 5-point scale, which indicated that they believed that administering, re-grading, and reviewing exams on the computer was manageable. With the support from the Center for Educational Technology Department, faculty could add new test questions, edit old test questions, set up the timing of the test, and in some cases, set up extended time for students who had special needs. Once the tests were set properly, administering tests just

involved releasing passwords to students at the right time. Students brought their laptops to the classroom and logged into the lockdown browser to access the tests. After students submitted their exam, their grades were automatically populated in their Angel LMS gradebook. In the SLBT program, all tests generated a robust item analysis, which gave faculty data to re-grade questions. Faculty could do question re-grading with a few button pushes in the Angel LMS, and re-grading could be applied to the entire class. Also, in the SLBT program, faculty had many options to conduct test reviews with their students. They could allow students to review their own tests to see which questions they missed, or they could project the test questions with answer keys on the screen for the entire class to review.

During the first year of SLBT program implementation in 2009, some nursing faculty were concerned about their computer competency in regards to administering computerized tests using the Angel LMS and laptops. This evaluation finding assures the Nursing Department and the institution that with continuous training and robust support from the technology support personnel, implementing computerized testing program is manageable for the majority of the nursing faculty.

#### Discussion of Evaluation Question 6

The quantitative data collected in this study provided the organization the results needed to address the SLBT program evaluation question 6: Is the laptop-based testing secure?

Faculty' mean score was 4.4 on a 5-point scale, which meant most of them believed that the SLBT was secure and cheating activities were minimized to the minimal level. All nursing exams were administered on ADU campus and were proctored by nursing faculty. In a typical nursing test, test security was enhanced by using the Respondus Lockdown Browser™ that disabled screen printing, copying and pasting, and browsing online for potential answer keys; in

addition, test questions were displayed one at a time and question order and question answer options were both randomized. Neighboring students would have different question orders; furthermore, exams were password protected so that only the students in the classroom could receive the password from faculty to access the exam.

This finding is important as the prior research literature showed many nursing program in the US hesitated to implement computerized testing due to security reasons (Tao & Li, 2012). Cheating behavior in computerized testing has become a serious issue for many instructors (Cizek, 1999; Lathrop and Foss, 2000; Dick et al., 2003; Kantrowitz et al., 2011; Tao & Li, 2012). Secure testing is especially critical in undergraduate nursing education. During the first year of SLBT program implementation in 2009, many ADU nursing faculty voiced their concerns on test security and possible cheating activities from students. This survey data analysis showed the current nursing faculty didn't perceive cheating as an issue in the SLBT program.

#### Discussion of Evaluation Question 7

Both quantitative and qualitative data collected in this study provided the organization the results needed to address the SLBT program evaluation question 7: If glitches happen during a computerized test, can technology support people resolve the problems quickly?

The technology support personnel's mean score was 4.5 on a 5-point scale, which indicated they could typically troubleshoot most laptop glitches in a timely manner in the classroom where the exams were on-going. Computer glitches and issues are unavoidable with any computer-based program (Tao et al., 2012). Most of the glitches were related to laptop operating systems glitches, laptop hardware malfunctions, Angel LMS system downtime, and the unstable campus wireless network. Consistent and rigorous technology support becomes crucial to the success of the secure laptop-based testing program. The university has two full-time

educational technologists who were responsible for the technology support for the SLBT program since 2009. From 2009 to 2014, they went to the exam classroom to help faculty start each secure test, especially during the first 10 minutes when most of the laptop or campus wireless network related glitches happened. After test administration, they helped, trained, and guided faculty to re-grade test questions, generate test item analysis, and set up test reviews.

Qualitative data from technology support personnel revealed that they had backup plans for situations where they couldn't fix the laptop glitches right before or during testing. For example, in case students forgot to bring their laptops to campus for testing or the laptop technical problems couldn't be resolved in a timely manner, the two technology support personnel were equipped with ten extra loaner laptops for students to use. Students also had a second option: they could go to the library to get fully equipped loaner laptops before their exams started.

In summary, discussions on evaluation question 1 to 7 showed that students enjoyed many benefits of the SLBT program such simulating the NCLEX-RN testing environment, instant grading and feedback, and convenient test reviewing, but they complained about the mandatory laptop purchase and various laptop, wireless network, and LMS related glitches during testing. On the other hand, nursing faculty and technology support personnel were very satisfied with the SLBT program. They believed that the SLBT program delivered secure exams to the students, helped students get prepared for their future computerized NCLEX-RN exam, and helped reduce faculty workload related to test preparation, test administration, and test management. These evaluation findings were very useful information for the Nursing Department and ADU institution: they assured the institution to continue to provide adequate resources to support the SLBT program; although, the institution needs to address issues of the

SLBT such as students' reluctance of purchasing new laptops, the poor laptop quality, and the technology challenges that students have experienced during testing.

#### Discussion of Results of NCLEX-RN Passing Rate Data

When the traditional paper-and-pencil method was used, during the 2007-2010 window, 80% of students passed NCLEX-RN the first time and 20% did not pass their first attempt. On the other hand, after the SLBT program was implemented, during the 2010-2013 window, 85% of students passed NCLEX-RN the first time and 15% did not pass their first attempt. There was no significant association between the two testing methods and whether or not students would pass NCLEX-RN the first time  $X^2(1) = 3.53, p > .05$ . This finding was consistent with some prior research conclusions that there was no meaningful statistical differences in terms of student performance in the paper-and-pencil mode and the computerized testing mode (Mead and Dragow, 1993; Wang, 2004; Poggio, Glassnapp, Yang, & Poggio, 2005). Based on the odds ratio in this study, however, the odds for students to pass NCLEX-RN the first time were 1.37 times higher if they were taught with the SLBT testing method than if taught with the traditional paper-and-pencil testing method. In other words, ever since spring 2010, after the first cohort of the nursing students who were exposed to the SLBT program graduated, the NCLEX-RN first-time passing rate has been improved on the ADU campus since then.

The findings were significant because a great number of prior research literatures showed that students' performance went down after switching from the paper-and-pencil testing mode to the computerized testing mode (Bunderson, Inouye & Olsen, 1989; Goldberg & Pedulla, 2002; Ito & Sykes, 2004; Keng, McClarty & Davis, 2006; Way, Davis & Fitzpatrick, 2006). Based on this study, the SLBT program in the Nursing Department at ADU did help nursing students better prepare for their future computerized NCLEX-RN exam, and it did reduce nursing

faculty's workload related to testing preparation, test administration, and test management. Therefore, it was worth the investment (cost, man hours, and information technology resources) for the institution to implement the SLBT program in the long term.

### Recommendations for the Organization

The study revealed that the SLBT program was found to be statistically significant. The SLBT program gave students hands-on experience on taking the exams on the computer, thus helping them better prepare for their future computerized NCLEX-RN exam. The SLBT program also has reduced nursing faculty's workload related to testing. From a technology support perspective, the SLBT program was also successful.

The timeframe to conduct this program evaluation was from fall 2013 to spring 2014. When the researcher started the program evaluation in fall 2013, he planned for a formative evaluation with the goal of improving the SLBT program. In spring 2014, however, due to the fact that Angel LMS phased out on the ADU campus and the current LMS is not capable of implementing secure testing, the SLBT program transitioned to a new phase as ADU started to use a commercial secure testing service ExamSoft TM to deliver secure nursing tests. ADU secure testing model thus transitioned from the LMS-based testing to the ExamSoft-based testing.

With LMS-based testing, faculty had more independence with regard to test question edit, test setup, re-grade, and test reviewing. With commercial testing services, faculty can lose independence if the technology support personnel solely prepare their exams. Currently at ADU, the Center for Educational Technology (CET) Department utilizes a centralized approach in terms of test preparation and administration: CET staff are in charge of loading test questions, setting up tests, exporting grades, and re-grading tests. Many nursing faculty has voiced their



concerns about the loss of independence with regard to testing preparation and management, compared with the previous LMS-based testing model. With regard to the institution, it is an extra expense to have a commercial testing service such as ExamSoft on top of the LMS contract expense. Therefore, once the current LMS's secure testing feature becomes mature, the institution may consider coming back to the old LMS-based testing model. Therefore, this evaluation study eventually served as a summative evaluation due to the recent LMS transition. As Fitzpatrick et al. (2011) stated, summative evaluations can help policy makers make decisions about the program's future or adoption. Based on the survey data analysis and discussion, the evaluator prepared the following three recommendations for the Nursing Department and the ADU institution:

1. Make sure to select the best possible quality laptops for nursing students if the Laptop Initiative Program (LIP) continues. An important component of the SLBT program was the laptop initiative and the quality of those laptops matters to students. The study results revealed the university should select better quality laptops for entry-level nursing students to purchase. In this study, students' perception of the SLBT program was negatively affected by the poor quality of the laptops they purchased from the university.
2. Re-evaluate the current Laptop Initiative Program (LIP). The administration can have an option of adopting an "open-laptop" initiative where students bring their own devices to take the computerized tests on campus. This, however, may force the university to increase the technology support level as it will be more challenging for technology support personnel to support different brands of laptops with different operating systems. Another motivation to re-evaluate the LIP is that, for those nursing students who didn't finish the nursing program due to failing grades or personal situations, they ended up

bringing home the purchased laptops. Currently, about 20% of the nursing students can't finish the nursing program, and they become the group of stakeholders who don't benefit from the secure laptop-based testing program. For many of those students who already have computers at home, those new laptops can be unnecessary expenses that cause them financial burden.

3. Take measures to further stabilize the campus wireless Internet network. Many issues reported by the students, faculty, and technology support personnel were related to the university wireless Internet network. Many students had the experience of getting kicked out of their tests due to unstable wireless networks. The Center for Educational Technology (CET) Department can work with the Information Technology (IT) Department to further investigate the bandwidth and stability of the university wireless network.

### Conclusions

This study revealed that the SLBT program exposed nursing students to the computerized testing environment and provided them hands-on experience on taking exams on the computer. At the same time, the SLBT program also helped reduce the faculty workload related to testing.

Secure laptop-based testing can happen on any campus when four requirements are satisfied: 1) the laptop initiative; 2) robust learning management system (LMS); 3) stable wireless campus; and 4) continuous support (Tao et al., 2012). Those four elements are considered the pillars for the success of secured laptop-based testing. Among those four pillars, this evaluation revealed that the quality of the laptops that students were asked to purchase played a “make or break” role in the SLBT program, for students not only used their laptops for testing, they also used them for other purposes such as online surfing, video streaming, word

editing. This evaluation also revealed that technology support was critical to the success of the SLBT program. Even with the laptop initiative program where students had the same brand of new laptops, there were times when laptops crashed before or during testing; consequently, without a rigorous and continuous technology support for the faculty and students, the SLBT program would not have been successful. When institutions are considering open-laptop option where students bring their own devices to their classrooms for testing, robust technology support becomes even more crucial to the success of the computerized testing program.

### Recommendations for Future Research

Based on the results of this research and the review of current literature on instructor-made, LMS-based computerized testing, the following suggestions are made for future research:

1. The secure nursing testing happened after the ADU campus started to use the Angel LMS in 2008. This indicates the importance of LMS secure testing features and functions if any institution plans to deliver instructor-made, LMS-based secure testing. Future evaluation research can report on different LMS testing features and functions so that institutions can borrow ideas from those evaluation reports when evaluating different LMSs.

2. Compared with computer adaptive testing, current research and program evaluation on instructor-made, LMS-based computerized testing is limited. When conducting program evaluations on computerized testing programs, it is critical to keep all program stakeholders in mind. For this SLBT program, the main stakeholders were nursing students; and the most easily ignored stakeholders were the nursing faculty and ADU as the institution. Future research can continue to expand the field of LMS-based, instructor-made computerized testing, especially from the point view of the institution's financial perspective and the faculty's perspective.

3. Reising (2003) stated that there were no significant differences in NCLEX-RN passing rates between the students who were only exposed to the traditional paper-and-pencil testing during nursing program and those who were exposed to computerized testing during nursing program. That study results might be skewed due to the fact that NCLEX-RN exam increased passing standard in 1998 and it might have caused lower passing rates during that period. Further studies on the relationship between laptop-based testing during nursing programs and nursing students' NCLEX-RN passing rate are recommended.

4. One of the ways to prevent cheating activities in computerized testing is to randomize question orders. Marks & Cronje (2008), however, reported that test questions randomization could pose a disadvantage to the students who had more difficult questions at the beginning of their tests. In this SLBT program, students were presented with the same questions but question order was randomized. Further study can report the impact of test question randomization on students' performance.

5. As more campuses are implementing computerized testing that requires students to have basic computer literacy such as keyboard and mouse skills and familiarity of windows operating system, institutions often assume that the majority of students have those basic computer literacy to participate in computerized testing. Greenberg (1998) voiced his concerns regarding computer literacy and pointed out that computerized testing could potentially discriminate against those with inadequate computer literacy. Further research can investigate how computerized testing affect this group of students who don't have adequate computer literacy.

6. Finally, computerized testing may increase testing anxiety for those students without previous experience (Vrabel, 2004). Fuszard (1999), however, reported that anxiety associated

with computerized testing could decrease with regular hands-on practice on the computer.

Further research can investigate if laptop related anxiety decreases with regular exposure to the laptop-based testing program.

APPENDIX A  
UCF IRB APPROVAL LETTER



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

### Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**  
**FWA00000351, IRB00001138**

To: **Jinyuan Tao**

Date: **June 05, 2014**

Dear Researcher:

On 6/5/2014, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review: Exempt Determination  
Project Title: EVALUATION OF A SECURE LAPTOP BASED TESTING PROGRAM IN AN UNDERGRADUATE NURSING PROGRAM  
Investigator: Jinyuan Tao  
IRB Number: SBE-14-10323  
Funding Agency:  
Grant Title:  
Research ID: N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 06/05/2014 02:05:56 PM EDT

IRB Coordinator

APPENDIX B  
ADU IRB APPROVAL LETTER





Institutional Review Board  
Len M. Archer, Chair  
671 Winyah Drive  
Orlando, FL 32803  
(407) 303-5619 T  
(407) 303-5671 F

To: Jinyuan Tao  
From: Len M. Archer, Ph.D.  
Date: October 29, 2013

Project Title: [Evaluation of a Secure Laptop Based Testing Program]  
Category: Educational

The Institutional Review Board of Adventist University has reviewed the above titled project and has determined that the proposed study is [ EXEMPT ] from IRB review and oversight as defined by 45 CFR 46.101 (b)(1). The study is not determined to be greater than minimum risk. The Principal Investigator accepts responsibility to comply with all Federal, State and University policies regarding the rights and welfare of human subjects.

Additional IRB review and approval is not required for this project as submitted. If you wish to change the protocol of your research study, you must submit subsequent changes for review.

If you have any further questions, please contact Dr. Len Archer at 407 303-5619 or [len.archer@adu.edu](mailto:len.archer@adu.edu).

Sincerely,

A handwritten signature in black ink, appearing to read "Len Archer".

Len M. Archer, PhD  
Chair, Institutional Review Board

IRB#: 00049ADU

Submission Date: 10/15/2013

Status: EXEMPT

Date of approval: 10/29/2013

New Submission  
 Resubmission  
 Multicenter Study

IRB Approval Form, Version 12/20/2012

APPENDIX C  
STUDENTS PERCEPTION SURVEY INSTRUMENT

Instructions: This survey is aimed to collect your feedback on the Secure Laptop-based Testing Program (SLBT). Noted this survey is anonymous and your honest feedback is greatly appreciated. Question 1-4 are Likert-scale format, please select the number below that best represents how you feel about the SLBT program.

**1. The Secure Laptop-based Testing (SLBT) program provides me an interactive experience on taking exams on the computer.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**2. The Secure Laptop-based Testing (SLBT) program will help me better prepare for the future National Council Licensure Examination for Registered Nurses (NCLEX-RN), which is also computerized.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**3. If glitches happen during a computerized test, the technology support people resolve them quickly.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**4. Overall, I am satisfied with the Secure Laptop-based Testing (SLBT) program.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**5. Besides taking the tests or quizzes online, I also use my laptop for other activities (please list them in the following box):**

**6. If I could change the Secure Laptop-based Testing (SLBT) program, here are my recommendations:**

APPENDIX D  
NURSING FACULTY SURVEY INSTRUMENT

Instruction: This survey is aimed to collect your feedback on the Secure Laptop-based Testing Program (SLBT). Noted this survey is anonymous and your honest feedback is greatly appreciated. Question 1-8 are Likert-scale format, please select the number below that best represents how you feel about the SLBT program; question 9 is open-ended.

**1. Compared with paper-and-pencil testing, the Secure Laptop-based Testing (SLBT) program reduces my workload that is related to testing.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**2. Compared with paper-and-pencil testing, administering, re-grading, and reviewing the computerized tests are more manageable for me.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**3. The Secure Laptop-based Testing (SLBT) program simulates most of the question formats that appear on the National Council Licensure Examination for Registered Nurses (NCLEX-RN).**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**4. I believe the Secure Laptop-based Testing (SLBT) program helps students better prepare for their future National Council Licensure Examination for Registered Nurses (NCLEX-RN), which is also computerized.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**5. Overall, I believe computerized testing is secure.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**6. Overall, laptop glitches are manageable for students during exams.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**7. I am satisfied with the technology support I receive from the Secure Laptop-based Testing (SLBT) program.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**8. Overall, I am satisfied with the Secure Laptop-based Testing (SLBT) program.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**9. If I could change the Secure Laptop-based Testing (SLBT) program, here are my recommendations:**

APPENDIX E  
TECHNOLOGY SUPPORT PERSONNEL SURVEY INSTRUMENT

Instruction: This survey is aimed to collect your feedback on the Secure Laptop-based Testing Program (SLBT). Noted this survey is anonymous and your honest feedback is greatly appreciated. Question 1-4 are Likert-scale format, please select the number below that best represents how you feel about the SLBT program. The last question is open-ended.

**1. Generally, if glitches happen during a computerized test, I can resolve them right in the testing classroom.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**2. Generally, if glitches happen during a computerized test, I can get them resolved very quickly.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**3. If I can't trouble shoot a glitch on a timely manner, here are my backup plans:**

**4. I believe the SLBT program helps students better prepare for their future National Council Licensure Examination for Registered Nurses (NCLEX-RN), which is also computerized.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**4. From technology support perspective, I believe the Secure Laptop-based Testing (SLBT) program works well.**

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

**5. If I could change the Secure Laptop-based Testing (SLBT) program, here are my recommendations:**



APPENDIX F  
EVALUATION PLAN

<b>SLBT Evaluation Timeline</b>				
<b>Dates</b>	<b>Evaluation Related Task</b>	<b>Who</b>	<b>Deliverables</b>	<b>Status</b>
2/3/2014	Attend a planning meeting	Nursing faculty, tech support person and university administrator	Introduce the purpose and objectives of the evaluation	
2/10/2014	Meeting with all nursing faculty	17 nursing faculty from all nursing courses throughout the four year	Administer an online survey asking faculty's perception on the SLBT program	
2/13/2014	Survey all nursing faculty for their feedback on SLBT	17 full time nursing faculty	Address their perception of the SLBT program, feedback, recommendations, exam security, exam re-grading and reviewing, exam management	
3/3/2014	Access the NCLEX-RN exam passing rate record from 2007 to 2013	The Nursing Department at ADU	Assess data to make a comparison to investigate if the SLBT program has improved students' performance	
3/17/2014	Create an online survey to students	All nursing students (n=185)	Address their perception of the SLBT program	
3/19/2014	Create a paper survey to technology support personnel	Two technology support personnel (n=2)	Address their perception of the SLBT Program	
3/24/2014	Complete summative evaluation report on the SLBT program	Evaluator	Draft the report to the university administrator	

APPENDIX G  
NCLEX-RN FIRST-TIME PASSING RATE

<b>Graduate Pass rates as per Florida Board of Nursing Statistics</b>					
<b>2012</b>	<b>Graduates</b>	<b>Candidates</b>	<b>Passed</b>	<b>Failed</b>	<b>% Pass</b>
Spring		53	44	9	83.02%
Summer		59	53	6	89.83%
Fall		56	55	1	89.83%
<b>2011</b>	<b>Graduates</b>	<b>Candidates</b>	<b>Passed</b>	<b>Failed</b>	<b>% Pass</b>
Spring	39	38	30	8	78.94%
Summer	44	43	40	3	93.02%
Fall		52	42	10	80.77%
<b>2010</b>	<b>Graduates</b>	<b>Candidates</b>	<b>Passed</b>	<b>Failed</b>	<b>% Pass</b>
Spring	41	39	31	8	79.48%
Summer	39	41	37	4	90.24%
Fall	45	46	40	6	86.96%
<b>2009</b>	<b>Graduates</b>	<b>Candidates</b>	<b>Passed</b>	<b>Failed</b>	<b>% Pass</b>
Spring	61	60	49	11	81.67%
Summer	37	39	33	6	84.61%
Fall	43	43	38	5	88.37%
<b>2008</b>	<b>Graduates</b>	<b>Candidates</b>	<b>Passed</b>	<b>Failed</b>	<b>% Pass</b>
Spring	55	54	39	15	72.22%
Summer	63	69	49	20	74.24%
Fall	48	38	34	4	89.47%
<b>2007</b>	<b>Graduates</b>	<b>Candidates</b>	<b>Passed</b>	<b>Failed</b>	<b>% Pass</b>
Spring	37	37	32	5	86.49%
Summer	46	44	38	6	86.36%
Fall	47	48	35	13	72.92%

APPENDIX H  
SPSS OUTPUT

### Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Testing Strategy * PassNCLEXRN	978	100.0%	0	.0%	978	100.0%

### Testing Strategy \* Passing Rate of NCLEX-RN Cross Tabulation

			PassNCLEXRN		Total
			NO	YES	
Testing Strategy	SLBT	Count	77	430	507
		Expected Count	88.1	418.9	507.0
		% within Testing Strategy	15.2%	84.8%	100.0%
		% within PassNCLEXRN	45.3%	53.2%	51.8%
		% of Total	7.9%	44.0%	51.8%
		Std. Residual	-1.2	.5	
Traditional Method	Count	Count	93	378	471
		Expected Count	81.9	389.1	471.0
		% within Testing Strategy	19.7%	80.3%	100.0%
		% within PassNCLEXRN	54.7%	46.8%	48.2%
		% of Total	9.5%	38.7%	48.2%
		Std. Residual	1.2	-.6	
Total	Count	Count	170	808	978
		Expected Count	170.0	808.0	978.0
		% within Testing Strategy	17.4%	82.6%	100.0%
		% within PassNCLEXRN	100.0%	100.0%	100.0%
		% of Total	17.4%	82.6%	100.0%

### Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exac t Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.532 <sup>a</sup>	1	.060	.064	.036
Continuity Correction <sup>b</sup>	3.222	1	.073		
Likelihood Ratio	3.532	1	.060	.064	.036
Fisher's Exact Test				.064	.036
N of Valid Cases	978				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 81.87.

b. Computed only for a 2x2 table

### Symmetric Measures

		Value	Appro x. Sig.	Exact Sig.
Nominal by	Phi	-.060	.060	.064
Nominal	Cramer's V	.060	.060	.064
	Contingency Coefficient	.060	.060	.064
N of Valid Cases		978		

### Effect Size

$\text{odds}_{\text{pass after SLBT}} = 430/77 = 5.58$
$\text{odds}_{\text{pass after traditional method}} = 378/93 = 4.06$
$\text{odds ratio} = 5.58/4.06 = 1.37$



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