Evaluation of Nursing Students' Informatics Competency Using an Adapted Self-Assessment of Nursing Informatics Competency Scale (SANICS) Tool

Undergraduate Research Thesis

Presented in Partial Fulfillment of the Requirements for Graduation "with Research Distinction in Nursing" in the Undergraduate Colleges of The Ohio State University

By
Anelise Zamarripa-Zoucha

The Ohio State University
May 2015

Project Advisor: Dr. Po-Yin Yen RN, PhD
Department of Biomedical Informatics
College of Medicine

Table of Contents

CHAPTER I: STATEMENT OF THE PROBLEM

The American Medical Informatics Association (AMIA) defines nursing informatics as the "*science and practice (that) integrates nursing, its information and knowledge, with management of information and communication technologies to promote the health of people, families, and communities worldwide*" (AMIA, 2015). As society and those in it shift towards a technology-based lifestyle, so must healthcare. The practice and concept of nursing informatics has received increasing attention for its immense importance to the present and future of healthcare. For example, hospitals all over the country have already switched over from paper-based documentation to electronic health record systems. In 2004, a federal mandate ordered that all Americans have an electronic health record by 2014 (Ornes & Gassert, 2007). Due to this switch, nurses and other healthcare professionals have limited choice other than to use the technologies provided. This being said, it is essential to educate the future of nursing (eg. nursing students) to be prepared for the future technology-assisted environment and be competent in using the technologies available in their practice to optimize their care. Unfortunately one of the most substantial barriers to this is that nurses, students and those already in practice, have little to no understanding of nursing informatics (Dixon & Newlon, 2010, p. 88). Not many studies were found to evaluate the effectiveness of nursing informatics courses for undergraduate and graduate nurses.

Breaking down and defining the essence of nursing informatics is key to a wider acceptance of its importance to healthcare. Many hold the belief that healthcare and technology do not walk hand in hand. We now know that "*information literacy is critical to incorporating evidenced-base practice into nursing practice*" (Ball & Hannah, 2011, p. 85). Nurses must, in conjunction with critical thinking skills, be able to find and use the information and resources

available to achieve best practice. It will take a major shift in the healthcare culture to bring about a widespread acceptance. According to nursing informatics specialist Patricia Hinton Walker, "*We need to view culture and culture change through the eyes of many different beholders, particularly when we discuss the use of informatics and technology where caring and technology actually do meet*" (Ball & Hannah, 2011, p.14).

Therefore, the purpose of this study is to assess the informatics competency of nursing students at one college of nursing at different levels of education. We want to gage and compare the general level of competency that students have learned in the past or are currently learning at present in their curriculum. We hypothesized that students who have taken informatics classes would have better informatics competency; also, students with higher education level should have better informatics competency.

CHAPTER II: REVIEW OF THE LITERATURE

As previously stated, there are a small amount of studies that have been conducted to evaluate nursing students' informatics competence. Most research focuses on evaluating a nursing student's general computer and informatics technology skills rather than their informatics roles and how they apply these informatics skills to clinical practice. Along with gaging nursing informatics competency, researchers have looked into specific factors and barriers that might affect a student's knowledge and experience with nursing informatics. Lack of informatics exposure in curriculum, confusion on the definition of informatics, and nursing educators' lack of informatics skills and definitions all may contribute to the student's competency.

In a study conducted in 2009 from the *Nursing Education Perspectives* journal, the researchers make a point that technology skills are necessary in nursing practice to provide positive patient outcomes. In their study, Elder and Koehn surveyed 61 undergraduate and RN to BSN students using a Computer Competencies Survey, which is an instrument consisting of statements asking students to rate themselves on a scale of 5 (expert) to 0 (no experience). Once students completed the survey, they were then prompted to complete a computer graded 40-question assessment to demonstrate their computer skills. The results found that students self-reported high computer skills, especially in the areas of word processing, spreadsheets, presentations, and Internet-related skills. Contrary to their perceived self-assessments, the results from the computer graded assessment showed that students only have the minimal skill level to pass a class. These findings indicated that many students might overestimate their true computer competency. (Elder & Koehn, 2009).

Another study suggested that nursing programs, specifically BSN programs, should integrate nursing informatics into their curriculum to properly prepare newly graduated nurses to use informatics at either the bedside or graduate school (Ornes and Gassert, 2007). The study evaluated a BSN program for its nursing informatics curriculum. Their research question was: *"what is the extent to which nursing informatics material is present in the courses in a BSN curriculum?"* Using a tool based off of the Categories of Informatics Competencies for the Beginning Nurse created by Staggers et al. (2001), 18 course syllabi in a BSN program were evaluated to determine if competency was present (Ornes and Gassert, 2007). From the evaluation of these 18 courses, the researchers found that BSN students in this program have some exposure to informatics but had very limited exposure to the actual technologies according to their syllabi (Ornes and Gassert, 2007).

Along with these informatics gaps in curriculum, the nursing educators tasked to create the curriculum pose as a barrier to nursing student informatics competency and its place in BSN programs. A small simulation study in 2010 investigated students enrolled in a PhD program, the future educators of nursing, and asked them to create a plan for integrating informatics into their simulated undergraduate nursing class (Dixon & Newlon, 2010). To accurately assess the simulations, the researchers brought in a co-chair from ANA that worked on the nursing informatics competencies and used the knowledge of a faculty member whom was a TIGER participant. Evaluation results found that of the 12 students that participated, only a few incorporated specific informatics competencies. The students also failed to incorporate any vital recommendations from both the American Nurses Association and TIGER initiative. Overall, the results indicated that in fact, the doctoral students "*do not all have a clear idea about what informatics is or what informatics competencies undergraduate nursing students might need in the future*" (Dixon & Newlon, 2010).

Another study in 2013 asked DNP students during the first week of the course to take an 86-item informatics competency assessment based off of competency statements. They found that competency scores did not differ significantly between the students and that overall the students were not competent in informatics (Choi & Zucker, 2013).

There are few studies that in the past five years have measured informatics self-assessment of students using tools, but they have only been of one education level. None have assessed or compared informatics competencies of undergraduate and graduate students at the same time.

CHAPTER III: METHODOLOGY

We conducted a cross-sectional study. An adapted survey questionnaire was distributed to evaluate nursing students' informatics competency.

Setting and Sample

The study was conducted at The Ohio State University College of Nursing in March of 2015. The target population was the junior and senior undergraduate students, RN-BSN students, master students, DNP students, and PhD students. Within these six programs, there are a total of approximately 1,535 students.

Instrument

We adapted a validated instrument, The Self-Assessment of Nursing Informatics Competency Scale (SANICS), which is a 30-item survey created and based off of the 93 recommendations from the TIGER Initiative. TIGER stands for Technology Informatics Guiding Education Reform. The TIGER initiative *"...was formed in 2004 to bring together nursing stakeholders to develop a shared vision, strategies, and specific actions for improving nursing practice, education, and the delivery of patient care through the use of health information technology"* (The TIGER Initiative, 2007). Within the initiative, the TIGER Informatics Competencies Collaborative (TICC) Team was also formed. The TICC *"...was formed to develop informatics recommendations for all practicing nurses and graduating nursing students"* (The TIGER Initiaitve, 2007). The team used surveyed education and research to identify the informatics gaps in practicing nurses and graduating nursing students. The goal of the team was to create recommendations that would guide the informatics education, practice, and delivery of healthcare recommendations. Recommendations from TIGER were split into three categories that included Basic Computer Competencies, Information Literacy, and Information Management.

SANICS is a 30-item instrument composed of five competency categories, including clinical informatics role, basic computer knowledge and skills, applied computer skills: clinical informatics, clinical informatics attitudes, and wireless device skills.

In this study, I adapted SANICS by adding additional items that were eliminated from the instrument validation process, but were essential competency skills recommended by the TIGER Initiative. The adapted scale (Figure 1) used in this study consists of the original 30-items from SANICS and 14-items from the TIGER recommendations, resulting in the 44-item survey. The chart below shows the 44-items used in the survey with the original SANICS items in plain text and the 14-items from the TIGER recommendations in bold text.

Table 1

Clinical Informatics Role
1. As a clinician (nurse), participate in the selection process, design, implementation, and evaluation of systems
2. Market self, system, or application to others
3. Promote the integrity of and access to information to include but not limited to confidentiality, legal, ethical, and security issues
4. Seek sources to help formulate ethical decisions in computing
5. Act as advocate of leaders for incorporating innovations and informatics concepts into their area of specialty
6. Identify and maintain a patient record
7. Capture patient oriented data
8. Manage patient history

Basic Computer Knowledge and Skills
1. Use telecommunication devices
2. Use the Internet to locate, download items of interest
3. Use database management program to develop a simple database
4. Use database applications to enter and retrieve information
5. Conduct on-line literature searches
6. Use presentation graphics to create slides, displays
7. Use multimedia presentations
8. Use word processing
9. Use networks to navigate systems
10. Use operating systems
11. Using existing external peripheral devices
12. Use computer technology safely
13. Navigate Windows

14. Identify the basic components of the computer system
15. Perform basic trouble-shooting in applications

Applied Computer Skills: Clinical Informatics
1. Use applications for diagnostic coding
2. Use applications to develop testing materials
3. Access shared data sets
4. Extract data from clinical data sets
5. **Focus and articulate the information need into a researchable question**
6. **Summarize the information retrieved**
7. **Determine the extent to which the information can be applied to the information need**
8. **Assess effectiveness of each step of the process and refine the search process in order to make it more effective**
9. **Understand the ethics of information use, such as knowing how and when to give credit to information and ideas gleaned from others by appropriately citing sources in order to avoid plagiarism**

Clinical Informatics Attitudes
1. Recognize that health computing will become more common
2. Recognize human functions that can not be performed by computer
3. Recognize that one does not have to be a computer programmer to make effective use of the computer in nursing
4. Recognize the value of clinician involvement in the design, selection, implementation, and evaluation of applications, systems in health care
5. **Interact with guidelines and protocols for planning care**
6. **Interact with clinical workflow tasking**
7. **Interact with clinical task linking**
8. **Manage Health information to provide decision support for standard assessments**
9. **Manage health information to provide identification of potential problems and trends**
10. **Interact with decisions support for result interpretation**

Wireless Device Skills
1. Use wireless device to download safety and quality care resources
2. Use wireless device to enter data

Taking into consideration the growth of health information technology today, the 14-items were added back into the survey to examine competency in many areas. Under the category of "Clinical Informatics Role", the three items were added because nurses have a responsibility and expectation to keep the patient records up to date with pertinent data and should be able to use the patient's record and history to shape the care of present problems.

The category of "Basic Computer Knowledge and Skills" did not have any additions from the TIGER recommendations because the items used in SANICS covered the basic computer skills necessary.

The category of "Applied Computer Skills: Clinical Informatics" had an addition of 5 items and added because nurses need to be competent and able to look at patient data, use that data to formulate a question about the patient's situation, turn that data into a question to research, and refine the search process to pick out relevant interventions to apply to patient care. During the search process, nurses also need to have the capability to determine the validity of the information they research. There is a very serious difference between information found on websites or Wikipedia versus evidence based research found in scholarly databases. Being able to use information and interventions from evidenced based research will result in effective, safe, efficient, and quality patient care.

Under the category of "Clinical Informatics Attitudes" there were 6 additions. These items were added because they are necessary informatics skills that all nurses must possess. These additional items deal with understanding the electronic health record software and using the records productively for patient care. Nurses, especially bedside nurses, use electronic health records everyday. Therefore, to increase workflow and to decrease workflow interruptions, the bedside nurse must be proficient in electronic health record usage.

Lastly, the final category of "Wireless Device Skills" had no additions from the TIGER recommendations.

Data collection

An electronic version of the 44-item survey was created in RedCap, which is "a secure, web-based application for building and managing online surveys and databases" (REDCap,

2015). Within REDCap, one may create and develop surveys, distribute the surveys via links, and then have the capability to export the data collected to various statistical software packages. A link was sent out to the students and lead to the survey, which consists of a demographics portion followed by the 44-item survey. The demographics questions ask each participant what year or program they are enrolled in, their specialty (if in graduate school), their age and gender, and if they have taken any informatics and/or general computer courses. At the end of the survey, each participant was asked if they would like to participate in a drawing. The incentive for completing the survey is a chance to win one of 5 $10 Starbucks gift cards. Though it is not required, to be eligible the participant must provide their email, which will only be used for the drawing.

Data analysis

After students responded to and submitted the surveys, all of the results collected were analyzed using SPSS software to run frequencies, means, t-tests, one-way ANOVA, and correlation analyses. I choose to perform these tests to explore the association of nursing students' informatics competency with age, education, computer competency, and experience in any informatics-related courses. By performing these tests, the goal was to compare groups (eg. Students whom have taken an informatics course and students whom have not taken an informatics course) and determine if there was any statistical differences in nursing informatics competencies between the groups.

CHAPTER IV: RESULTS

The data from the demographics questions was used to run frequency tests and produce results about the respondent population. The self-reported competency from the responses was used to perform means comparisons, t-tests, one-way ANOVAs, descriptive analysis, and correlations.

Demographics

With the data collected, a total of 120 students responded to the survey but only 83 of the surveys were complete and valid. For a survey response to be valid, 80% or more of the questions had to be completed by the respondent.

Of the 83 respondents, seventy-seven were female, four were male, and two were unknown. The age range of the respondents ranged from ages 20-62 years old. The education and the programs of the respondents greatly varied. The category of undergraduate students consisted of 7 junior level students, 10 senior level students, and 7 students were in the RN to BSN program. Students in a Master's program compromised 48 of the respondents. Finally, the doctoral students included 6 DNP (Doctorate of Nursing Practice) students and 5 PhD students.

Figure 2
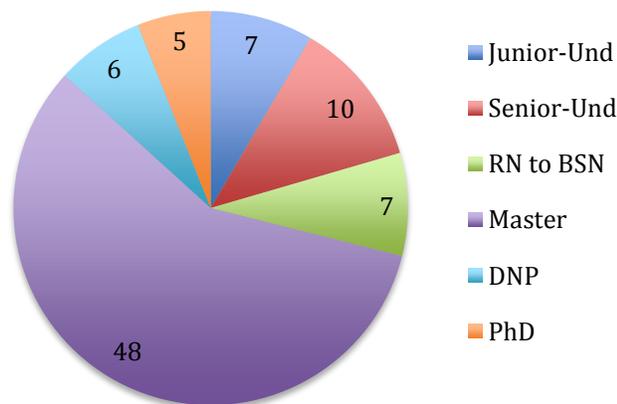
In the second part of the demographics survey, respondents were asked about past or present informatics courses, the number of informatics courses taken, if they had ever taken a computer class, and finally, asked to rate their personal computer competence on a scale from 1 ("not competent at all") to 5 ("very competent"). From the respondent's replies 42.2% (n=35) had never taken an informatics course while 57.8% (n=48) had previously taken an informatics course.

No undergraduate respondents reported that they had taken an informatics class; only respondents at the master level or higher had previously taken an informatics course. Of those 48 respondents that had previously taken an informatics course (Figure 3), 83.3% (n=40) have taken one course, 12.5% (n=6) have taken two courses, and 4.2% (n=2) have taken four or more informatics courses. When asked about computer classes, 47% (n=39) had never taken a class while 53% (n=44) had taken a computer class of some degree.
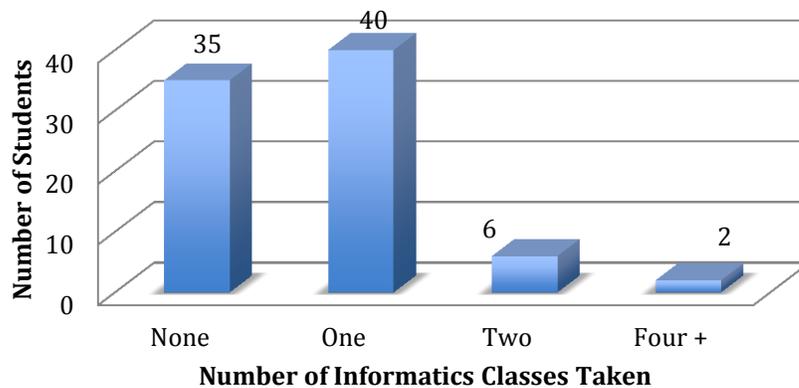

Figure 3

Self-assessed informatics competency

The results produced averages of self-assessed competence and statistical significance and correlations between factors related to informatics competence. Figures 4 below illustrates the overall, highest, and lowest means of the students in each educational level.

The undergraduate junior level students (n=7) self-reported an overall mean= 3.28 (SD=. 37) in their informatics competency. These students self-reported highest in the category of "Wireless Device Skills" (mean= 3.86, SD=. 85) and lowest in the category of "Applied Computer Skills: Clinical Informatics" (mean= 2.41, SD= .76). The undergraduate senior level students (n=10) self-reported an overall mean= 3.42 in their informatics competencies. The senior level students self-reported highest in the category of "Basic Computer Knowledge and Skills" (mean= 3.76, SD= .68) and lowest in the category of "Applied Computer Skills: Clinical Informatics" (mean= 2.81, SD= .83). The RN to BSN students (n=7) self-reported the lowest overall average of the groups, with a mean= 2.89 in their informatics competency. These students self-reported highest in the "Clinical Informatics Attitudes" (mean= 3.10, SD= .72) category and lowest in the category of "Applied Computer Skills: Clinical Informatics" (mean= 2.49, SD= .64).   The respondents from the masters program (n=48) self-reported an overall mean= 3.38 in their informatics competency. The students self-reported highest in the category of "Basic Computer Knowledge and Skills" (mean= 3.66, SD= .73) and lowest in the category of "Applied Computer Skills: Clinical Informatics" (mean= 2.91, SD= .89). The DNP students (n=6) self-reported an overall mean=3.69 in their informatics competency. This group of students self-reported highest in the category of "Clinical Informatics Attitudes" (mean= 4.10, SD= .40) and lowest in the category of "Clinical Informatics Role" (mean= 3.18, SD= .16). Lastly, the PhD students (n=5) self-reported an overall mean= 3.33 in their informatics competency. The PhD students self-reported highest in the category of "Clinical Informatics Attitudes" (mean= 3.64, SD= 1.42) and lowest in the category of "Applied Computer Skills: Clinical Skills" (mean= 2.88, SD= .58).
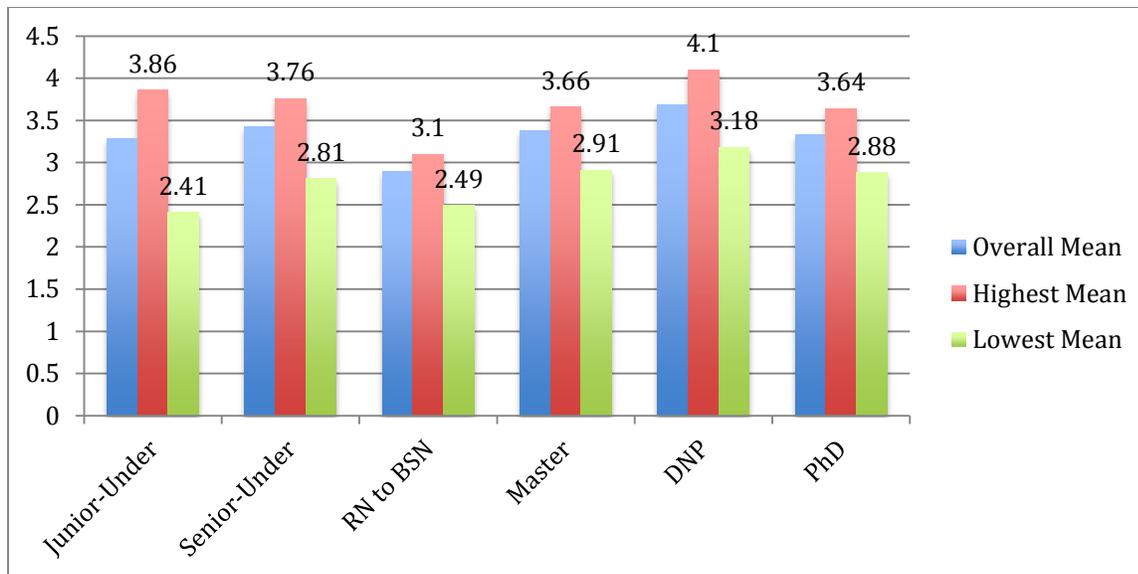
In relation to the number of informatics courses taken, we found that the higher the number of informatics classes taken resulted in a higher overall self-reported informatics competency average. Those that had never taken an informatics course (n=35) on average self-reported an overall mean= 3.19. The respondents that had previously taken one informatics course (n=40) on average self-reported an overall mean=3.41. Only a handful of students (n=6) had previously taken two informatics courses, and on average they self-reported an overall mean= 3.67. Even fewer students (n=2) took four or more courses, but on average these 2 respondents self-reported an overall mean=3.98.

A post hoc, multiple comparisons test showed no statistical significance (p= 1.00) between the overall self-reported average and one's nursing education level. Multiple comparisons between the self-reported average of each category ("Clinical Informatics Role", "Basic Computer Knowledge and Skills", etc.) and one's nursing education level also show no statistical significance (p= ~1.00). As illustrated below in Figure 5, across the three educational levels (Undergraduate vs. Master vs. Doctoral; mean= 3.23 vs. 3.38 vs. 3.53), a one-way ANOVA showed that there were no statistically significant differences (p= .389) among the three

levels. Another interesting finding was a noticeable trend within the undergraduate respondents which shows that the RN to BSN students self-reported a lower informatics competency (mean=2.89) while the undergraduate juniors and seniors self-reported informatics competencies of mean=3.27 and mean=3.42 respectively.

Figure 5

Average Self-Reported Competence Per Education Level
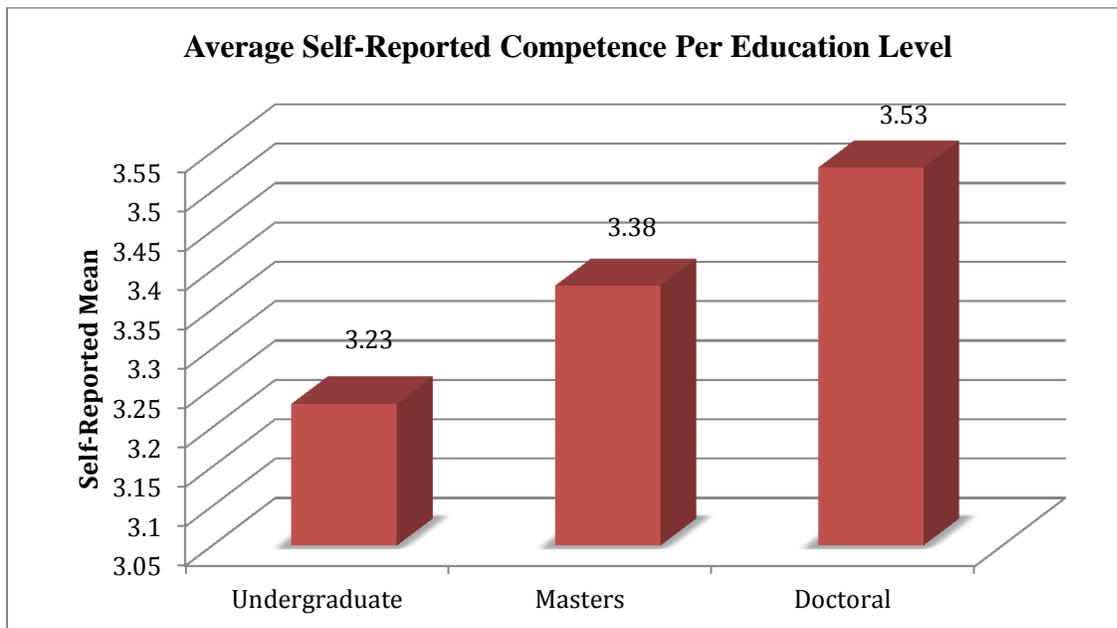
A one-way ANOVA test (Figure 6) revealed that the overall average self reported competency was statistically significantly different between the groups that had not taken an informatics course vs. the group that had taken a course (p=0.048). More specifically, the categories of "Clinical Informatics Role" (p=. 002) and "Applied Computer Skills" (p=.05) were statistically significantly different while the categories of "Basic Computer Knowledge" (p=.260) and "Clinical Informatics Attitudes" (p=.253), and "Wireless Device Skills" (p=.886) showed no statistical difference.

Figure 6

Self-Reported Compentency and Informatics Class Taken or Not Taken
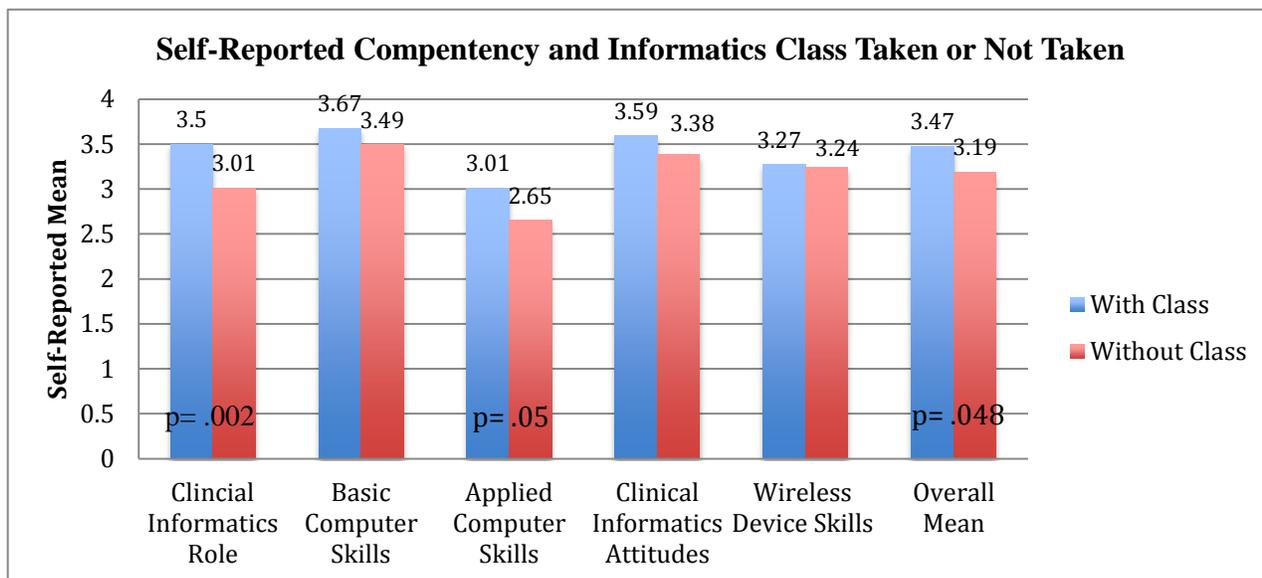
Category	With Class M (SD)	Without Class M (SD)	p
Clinical Informatics Role	N=48 3.5040 (.68465)	N=35 3.0187 (.65134)	.002
Basic Computer Knowledge and Skills	N=47 3.6721(.70782)	N=35 3.4932 (.70540)	.260
Applied Computer Skills: Clinical Informatics	N=47 3.0121 (.84456)	N=35 2.6532 (.75192)	.050
Clinical Informatics Attitudes	N=45 3.5911 (.75252)	N=35 3.3867 (.83705)	.253
Wireless Device Skills	N=45 3.2778 (1.16070)	N=35 3.2429 (.95772)	.886
Overall Mean	N=48 3.4724 (.63436)	N=35 3.1980 (.58909)	.048

Among other interesting results, after running correlation tests, the data also showed that if the respondent reported a high computer competency, they also reported a higher informatics competency means across all categories (r= 0.339 ~ 0.639, p<0.001). There was no significant difference in the results of a correlation test between computer competency, informatics competency, and age.

CHAPTER V: DISCUSSION

From the data analysis, results conclude that students whom have taken an informatics class report a statistically higher nursing informatics competency. These respondents most likely have more self-confidence and more proficiency in informatics because of the knowledge learned in their informatics courses. The "Clinical Informatics Role" and "Applied Computer Skills: Clinical Informatics" categories may be statistically significantly different between those whom have taken an informatics course and those whom have not taken a course, because with an informatics course, a student would better understand the use of data and health information technology to improve patient care in nursing practice. Students may understand the concept of nursing informatics, but they may not understand how to use their skills as a clinician or bedside nurse. A student may also have a high computer competency and high computer skill level, but might not possess the knowledge to apply these skills to nursing informatics.

Currently, informatics classes are not included in the BSN curriculum. With the informatics course in their curriculum, undergraduate students may be more prepared to effectively utilize technology as a bedside nurse. Using evidenced-based recommendations should steer the future of nursing informatics in the right direction through curriculum reform and the preparation of future nursing educators.

Limitations

With further research, I would include a larger and more diverse sample size. Specifically, I would like more responses from undergraduate students. Students were given a few weeks to complete the survey, so in the future, more time and more reminders might increase response rate. The survey was sent out to approximately 1,500 students at the College of

Nursing, and only 127 of the students responded. A little over 80 of the responses were valid which rounds the response rate out to approximately 13%.

Future Recommendations

If I were to continue this research, I would look into distributing the survey to various universities and nursing programs and conducting the same type of data analysis I did with my survey results. I am very interested to know if the results would dramatically change with certain programs, and if so, why they would change. Along with broader distribution of the survey, I would try to work with informatics technology experts to create a graded assessment with questions that would accurately evaluate a nursing student's true informatics competency. A student could very well be overestimating or underestimating their competence when they self-assess. With results from both the survey and assessment, we might be able to determine one's valid informatics competency versus one's self-evaluated competency.

Finally, to continue this study I would also learn how to run and analyze the results of exploratory factor analysis and psychometric analysis tests to determine the validity, quality, and structure of the adapted survey.

CHAPTER VI. CONCLUSION

Our study findings indicated that students whom have previously taken an informatics course reported a slightly significant higher mean competency score overall than students whom have not taken an informatics course. More specifically, students whom have taken informatics classes reported higher informatics competency in the categories of "Clinical Informatics Role" and "Applied Computer Skills: Clinical Informatics" . All levels of education, with the exception of the DNP students, scored the overall lowest mean in the category of "Applied Computer Skills: Clinical Informatics". But there was no significant difference between the various

education levels. Out of the education levels, trends and means indicated that the RN to BSN students had the lowest mean competency overall. The data also indicated that there was a correlation that students whom reported a higher computer competency also reported a higher informatics competency. As it was recommended to develop informatics competency for all practicing nurses and graduating nursing students, including informatics class(es) in the BSN curriculum could help students be more prepared to effectively utilize technology as a bedside nurse.

References

American Medical Informatics Association. (2015). AMIA Nursing Informatics Working Group.

   https://www.amia.org/programs/working-groups/nursing-informatics

Ball, M.J. & Hannah, K.J. (Eds.). (2011). *Nursing Informatics: Where Technology and Caring*

   Meet, Fourth Edition. New York, NY: Springer-Verlag London.

Choi, J. & Zucker D.M. (2013). Self-assessment of nursing informatics competencies for

   doctorate of nursing practice students. *Journal of Professional Nursing, 29* (6), p. 381

   387. http://dx.doi.org/10.1016/j.profnurs.2012.05.014

Dixon, B.E. & Newlon C.M. (2010). How do future nursing educators perceive informatics?

   Advancing the nursing informatics agenda through dialogue. *Journal of Professional*

   Nursing, 26 (2), 82-89. doi: 10.1016/j.profnurs.2009.05.001.

Elder, B.L. & Koehn, M.L. (2009). Assessment tool for nursing student computer competencies.

   Nursing Education Perspectives, 30 (3), 148-152. http://dx.doi.org/10.1043/1536-5026-

   030.003.0148

IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM

   Corp.

Ornes, L.L. & Gassert, C., (2007). Computer Competencies in a BSN Program. *Journal of*

   Nursing Education, 46 (2), 75-78.

REDCap Software. Released 2015. Version 5.5.5. Nashville, TN: Vanderbilt University

The TIGER Initiative Foundation, (2007). The TIGER Initiative: Informatics Competencies for

   Every Practicing Nurse: Recommendations from the TIGER Collaborative.

   http://www.thetigerinitiative.org/docs/TigerReport_InformaticsCompetencies_000.pdf.

Yoon, S., Yen, P.-Y., & Bakken, S., (2009). Psychometric Properties of the Self-Assessment of

Nursing Informatics Competencies Scale. *Studies in Health Technology and Informatics*,

146, 546–550.