How Does the Use of a Mobile Application Impact Learning

Among Clinical Nursing Students in Patient Care Settings?

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October 28, 2018

Abstract

The use of mobile technology for teaching and learning is transforming academia (Day-Black & Merrill, 2015). The overarching goal is to continuously improve and advance our teaching in the School of Nursing, while pursuing innovative educational ideas. The purpose of this research study is to implement an innovative, educational intervention to undergraduate nursing students in the patient care setting, and then evaluate its impact on knowledge, skills, anxiety, and self-efficacy. This study is a mixed methods design, with a convenience sample size of ~100 undergraduate nursing students and ~20 clinical nursing faculty. The educational intervention will include the use of a mobile scanning application, as well as a smartphone or electronic tablet device, and newly created codes that will be loaded with essential educational materials that students need while in clinicals at the point of patient care. A variety of data will be collected pre and post the educational mobile application intervention. Descriptive statistics as well as parametric/nonparametric analyses will be conducted for the quantitative data; while the qualitative data will be reviewed and summarized for common themes. By integrating technology-based education at the point of patient care, this may have the potential to better connect the knowledge and theory learned in the classroom setting to the actual patient care performed at the bedside. If nursing students can improve their knowledge, skills, anxiety levels, and self-efficacy, this may better support their successful transition to professional practicing nurses in the healthcare environment.

<h1 style="text-align:center">Revised Budget Request Page
January 15, 2019 to May 30, 2020</h1>

BUDGET: *Request by budget category. Joint proposers must select one PI to be the lead and one department to receive this allocation.*

Lead Principal Investigator: **Lee-Ann T. Kenny**

Principal Investigator 800#: 800396577

Title of Project: How Does the Use of a Mobile Application Impact Learning Among Clinical Nursing Students in Patient Care Settings?

Allocate operating budget to Department of: School of Nursing in the CHHS

Fiscal Year One (January 15, 2019 to May 30, 2019)		
Faculty Stipend	Paid directly from Academic Affairs fund on May 15, 2019	
911250	Graduate Student Salaries	
911300	Special Pay to Faculty other than Grantee	
915000	Student (Undergraduate or Graduate) Temporary Wages	
915900	Non-student Temporary Wages	
920000	Honorarium (Individual(s) not with UNCC)	
921160	Subject Incentive Fee	
925000	Domestic Travel	
926000	Foreign Travel	
928000	Communication and/or Printing	
930000	Supplies	
942000	Computing Equipment	
944000	Educational Equipment	
951000	Other Contracted Services	
Year One Subtotal		$0

Lead Principal Investigator: **Lee-Ann T. Kenny**

Fiscal Year Two (July 1, 2019 to May 30, 2020)

Faculty Stipend	Paid directly from Academic Affairs fund on May 15, 2020	
911250	Graduate Student Salaries	2400.00
911300	Special Pay to Faculty other than Grantee	
915000	Student (Undergraduate or Graduate) Temporary Wages	
915900	Non-student Temporary Wages (see PD-17)	
920000	Honorarium (Individual(s) not with UNCC)	
921160	Subject Incentive Fee	200.00
925000	Domestic Travel	3000.00
926000	Foreign Travel	
928000	Communication and/or Printing	580.00
930000	Supplies	
942000	Computing Equipment	
944000	Educational Equipment	
951000	Other Contracted Services	207.00
Year Two Subtotal		
TOTAL FUNDS REQUESTED (Year One + Year Two)		$6,387.00

SoTL Proposals that do not receive SoTL funds may be eligible for support from the Office of Assessment and Accreditation. If your SoTL proposal is not recommended for funding, would you like for your proposal to be shared with the Office of Assessment for review and consideration for funding from that office?   YES_____
NO_____

Budget Narrative

Faculty Stipend (3850)

Dr. Kenny holds a full time 9-month appointment and thus is not employed during the summer months. Dr. Kenny will use this time in the summer to prepare QR codes, develop a teaching plan for faculty and students, and prepare data collection tools for August implementation.

Graduate Student Salaries (2400)

A graduate assistant will be requested to help with the data collection and analysis during the fall 2019 semester at $15/hour for ~ 10 hours per week x 16 weeks semester.

Subject Incentive Fee (200)

Clinical nursing faculty will be offered a $10 coffee shop gift card for participating in the Focus Groups. 20 faculty x $10.

Domestic Travel (3000)

The goal for dissemination is to attend and present a podium/poster at both a state level conference and a national nursing conference. The state level conference will be attended by Dr. Gaston which will include a registration fee, cost of hotel, and mileage reimbursement totaling approximately $1000. The national conference will be attended by Dr. Kenny which will include a registration fee, airfare, and hotel totaling approximately $2000. If the abstract is not accepted for presentation, then a similar type nursing conference will be selected.

Communication/Printing (580)

Printing and laminating the pocket guides of QR codes will be needed for students to scan via smartphone/tablet. $ 4 per pocket guide for 145 participants will be purchased. Electronic tablets will be borrowed from Atkins Library for each clinical faculty (~20).

Other Contracted Services (207)

QR Code Monkey is the platform that will be used to create QR codes into a traceable code that retrieves data each time a code is scanned. This will allow the researchers to analyze use of the technology which is essential. A year subscription for this technology is $207.00.

Center for Teaching and Learning.
Scholarship of Teaching and Learning
UNC Charlotte, Kennedy 202
Charlotte, NC 28223

Dear SOTL Grant Selection Committee:

I write this letter in support of the SOTL Grant proposal submitted by Drs. Lee-Ann Kenny and Teresa Gaston. Their project titled "*How Does the Use of a Mobile Application Impact Learning Among Clinical Nursing Students in Patient Care Settings?"* aims to implement an innovative, educational intervention to enhance patient safety in the clinical setting. Following the intervention, participants will be evaluated to determine the impact the intervention had on knowledge and skill acquisition, as well as its impact on perceived anxiety, student self-efficacy and quality of care.

Improving patient outcomes, as well as satisfaction, is a priority in healthcare. In today's healthcare environment, students are faced with caring for increasingly complex clients with multiple healthcare needs. Therefore, ensuring that students are prepared to provide high quality, evidence-based care, at the bedside, is paramount to patient safety. Research has shown that student anxiety, as well as an overall lack of confidence, may contribute to medical errors, as well as a desire to leave the profession (Wedgeworth, 2016). The proposed project will provide students with valuable, on-demand educational resources that may be accessed during the clinical experience, with the goal of alleviating their anxiety related to knowledge and skill performance, while at the same time, enhancing self-efficacy and ensuring the provision of quality care.

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Dr. Kenny piloted a similar study last year which examined the use of mobile technology on student anxiety. The study revealed that use of mobile technology to access such items as critical lab value ranges, detailed processes for high risk procedures and common nursing interventions, decreased student anxiety during the clinical experience. If funded, this project will provide the opportunity to extend Dr. Kenny's original research to explore the use of mobile technology on additional concepts which negatively impact both students and the patient's they care for. Dr. Gaston supports this project by sharing her professional knowledge as a board certified nurse educator and nurse informaticist.

I offer my full support to this teaching and learning proposal.

Sincerely,

Dena Evans, EdD, MPH, MSN, RN, CNE, CNL-BC

Director, School of Nursing

The Baccalaureate Degree in Nursing/Master's Degree in Nursing/Doctor of Nursing Practice and/or Post-Graduation APRN Certificate at The University of North Carolina at Charlotte is accredited by the Commission on Collegiate Nursing Education www.ccneaccreditation.org

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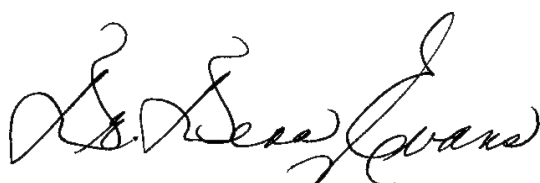
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Project Narrative

A. Specific Aims

The purpose of this research study is to implement an innovative, educational intervention to undergraduate nursing students for the patient care setting, and then evaluate if any impact on knowledge, skills, anxiety, and self-efficacy occurs. The proposal seeks to accomplish these objectives:

- Promote innovative learning opportunities for students in the patient care clinical settings using technology;

- Educate nursing students and faculty on the use of mobile application technology to improve student knowledge and skills at the point of patient care;

- Enhance student nurses' ability to connect knowledge and theory to patient care practice; and

- Improve students' perceptions of their anxiety and self-efficacy levels.

Research Questions:

1. Does student knowledge increase regarding assessment/procedural/psychomotor nursing skills after using mobile application technology in clinical settings?

2. What are students and faculty perceptions of technology use in clinical settings?

3. Do student perceptions of their anxiety levels change after using smartphones/tablets in the clinical setting?

4. Do student perceptions of their self-efficacy change after using smartphones/tablets in the clinical setting?

Rationale:

The use of mobile technology for teaching and learning is transforming academia (Day-Black, 2015). Taking advantage of mobile technology in nursing school programs may strengthen student learning by opening doors and paving the path to independent, student-centered learning (Forehand, et al., 2017). The mobile application for Quick Response (QR) codes has been used in educational programs to enhance teaching and learning, thus allowing self-guided learning and more autonomy. By bringing educational resources via mobile technology and scanning applications to students while in a fast paced, chaotic healthcare environment, this has the potential to enhance their learning in the application of knowledge. The use of smartphones and electronic tablets in nursing clinicals can promote patient safety through an information technology approach.

The overarching goal is to improve and advance our teaching and learning for both faculty and students utilizing technology. Anxiety levels are often too high among nursing students, thus inhibiting the learning process when caring for patients. Nursing faculty are often outnumbered in the clinical setting of hospitals and long-term care centers. This research project stems from a recent 2017 pilot study which resulted in decreasing anxiety levels after implementing smartphones/tablets with the QR code technology in nursing clinicals. However, self-efficacy is broadly defined as one's ability to perform is based on the probability of their success (Van Horn & Christman, 2017), which may better capture how students feel about their nursing abilities. As nursing schools are responsible for producing competent, beginner level nurses to enter the healthcare workforce, self-efficacy holds significant importance to professional nurse success. Also, this project aligns with professional nursing guidelines from

The Essentials of a Baccalaureate Education (AACN, 2018), and the Quality Safety Education

for Nurses Informatics and Safety competencies (QSEN, 2018).

Impact:

The UNCC School of Nursing is a designated Center for Excellence and strives to be

ahead of the curve and remain competitive in nursing education, however integrating the use of

technology in nursing curriculum during patient care clinicals is a new concept. Faculty have the

option to grow and advance their teaching practices with technology and our Generation Z

nursing students have the option to use smartphones/tablets in a professional and educational

manner to improve their nursing knowledge, skills, anxiety, and self-efficacy while in clinicals.

The results can impact the learning outcomes for ~100 undergraduate nursing students. It is time

to close the knowledge theory to practice gap, thus graduating professional nurses ready for the

workforce and using smartphone applications for up-to-date educational information.

B. Literature Review

Mobile Technology

According to the Pew Research Center (2018), 100% of adults 18-29 years old own a

cellphone while 94% of them own a smartphone device, which has greater functional

capabilities. Based upon a study (Mobasher et al., 2015), 95% of professional, practicing nurses

had smartphones and 53% of these nurses found the use of smartphones to be very useful or

useful in helping them to perform their clinical duties. Their perceptions of smartphone use in

clinical practice was found to be helpful, essential, brilliant and innovative (Mobasher et al.,

2015). However, the use of smartphone and tablet technology in nursing education is variable

and controversial, even though healthcare is considered a highly technical environment. Mather,

Cummings & Gale (2018) supports the use of mobile technology in undergraduate nursing curriculum as well as the importance of modeling digital professionalism to help students develop the knowledge, skills, and attitudes to become competent users of mobile technology in the patient care setting. Nursing informatics experts have endorsed the use of smartphones by undergraduate nursing students to better support competent nursing care (TIGER, 2009).

The use of mobile technology is being seen across the educational spectrum as a method for easy access to resources for both the classroom and clinical environments (Mann, Medves & Vandenkerhof, 2015). Access to such resources are often difficult for students during clinical because computers are shared with all healthcare staff, and space is limited for students to bring books and other classroom materials. According to Wittmann-Price, Kennedy & Godwin (2012), technology that allows for quick access to resources, improves students' aptitude and assurance in making decisions related to patient care. A significant advantage to implementing mobile technology includes a decrease in medical errors thus improving patient safety during clinical experiences (Day-Black & Merrill, 2015). The nursing students from a study by Patterson, et al., (2013, p. 417) stated that the use of mobile technology "lowered my stress about getting necessary information during clinical practice and increased my ability to independently get information without asking my clinical instructor."

QR Codes

QR technology can improve the teaching learning process by linking valuable resources to a two-dimensional bar code that can be read on mobile devices such as a smartphone or electronic tablet. According to Zupanovic and Tijan (2012), QR technology will allow the formation, usage, and dissemination of information anywhere and anytime. While QR technology began approximately 15 years ago, it was only recently when this

technology found its way into education (DeSilets, 2012). Garrett, Jackson, and Wilson (2015) utilized QR technology in clinical labs as augmented reality mobile learning by linking educational resources to QR codes to further nursing student's clinical education while in the skills practice lab. Tracey, et al., (2013) engaged their nursing students in an innovative learning activity linking QR codes to a step-by-step demonstration of nursing skills and found that the use of QR codes enabled student autonomy by promoting self-directed learning.

Knowledge-Theory-Practice Gap

Clinical instructors need to be cognitive of the knowledge-theory-practice gap. They need to continue to weave knowledge and theory into clinical application to enhance student learning and decrease anxiety. Clinical experiences are required in nursing school and help students strengthen their professional nursing skills, but also to develop a stronger sense of research, theory, and principles (Sun et al., 2016). Rajeswaran (2016) stated that the theory-practice gap can generate conflict, thereby negatively impacting student learning. Besides growth in knowledge, mobile technology allows for instant access to needed information during the clinical experience and it is also likely to enhance nursing skills (O'Connor & Andrews, 2015; as cited in Mackay, et al., 2017).

Self-Efficacy

It is important to have self-efficacy, as it promotes assurance in nursing students as they progress through their learning (Van Horn & Christman, 2017). Self-efficacy is defined by Van Horn & Christman (2017), as one's ability to perform is based on the probability of success. According to Bandura (1977), anxiety levels can affect self-efficacy. Therefore, as nursing faculty, we strive for our nursing students to feel low to moderate levels of stress and

high levels of self-efficacy in order to successfully transition into their professional practice role upon graduation. For nursing students in patient care clinicals, the use of mobile devices promotes self-efficacy (Kuiper 2008; Goldsworthy et al. 2006). Improved knowledge and self-efficacy were seen in the study conducted by Kim & Suh (2018) which used mobile technology linked to nursing skills. In academic settings, self-efficacy is a strong predictor of overall performance. The development of self-efficacy in nursing practice not only will help in the decrease of anxiety levels seen in nursing students, but also allow for a safer environment for patient care.

C. Methods

It is a mixed methods design including a convenience sample of ~100 undergraduate Junior and Senior nursing students, who will be voluntarily recruited through an informational email that will include a consent form. Clinical nursing faculty ~20 will be emailed a voluntary request to participate in a focus group prior to implementation to gather their perceptions of top priority educational resources needed for students while in the clinical setting.

Procedure

Step 1: Focus groups will be conducted with clinical nursing faculty to gather their perceptions of priority educational resources that students need at the point of patient care. The priority educational resources will then be linked to individual QR codes. The educational training sessions will be developed based upon this information gathered.

Step 2: Electronic tablets will be borrowed from the UNCC Atkins Library. Some faculty and students may choose to bring and use their own smartphone/tablet device as well. The educational training program will include a demonstration on how to use the scanning mobile

application on the smartphone/tablet and the QR codes. The training will include both faculty

and students in a classroom setting. The participants will download a free, mobile application

called CamScanner. They will get to practice the use of the mobile application CamScanner

with scanning our designed QR codes in a classroom setting and any questions will be

answered. Pocket guides will be created with these QR codes for students and faculty to carry

with them while providing patient care. Internet is necessary; however, all clinical facilities

have a guest Wi-Fi internet access. See Figure 1.

Figure 1: Project Technology Tools

| Smartphone	CamScanner App	QR Code for a nursing skill

Step 3: Students will attend patient care clinicals in the Fall semester, and the implementation

time period for the educational intervention will be ~8 weeks.

Step 4: Data will be collected pre and post the educational mobile application intervention.

Demographics (Appendix A) and the Faculty Focus Group Questions (Appendix B) will be

completed pre-intervention only. Questions regarding technology perceptions by students

(Appendix C) will be administered post intervention only. The General Self Efficacy (GSE)

tool (Appendix D), Knowledge Quiz (Appendix E), and the State Trait Anxiety Inventory

(STAI) survey (Appendix F) will be administered pre-post the educational intervention to

measure any change. Several limitations of this study include the following: faculty

participation in the focus groups (gift card incentives will be offered), and most data collection

will be via self-reported survey tools which have inherent limitations. See Figure 2.

Figure 2: Procedural Steps of Project
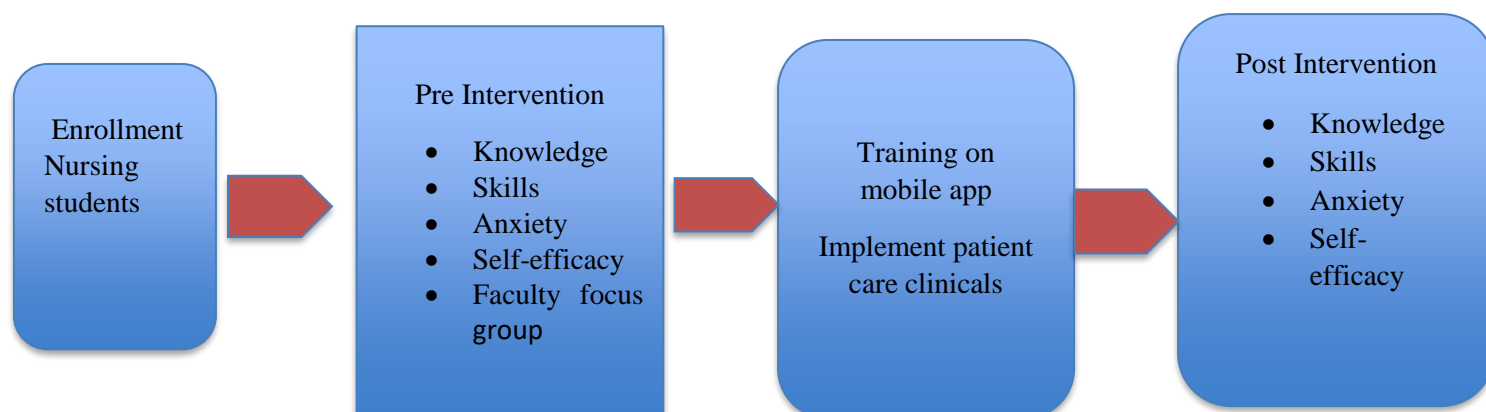
D. Evaluation

Data analysis will be conducted using descriptive statistics, independent t test and/or

paired t test to compare differences in knowledge, anxiety, and self-efficacy. Statistical

significance will be $p < .05$. Common themes will be summarized by two reviewers for

qualitative data.

- **RQ1 (Knowledge Quiz)** will be answered by the development and administration of a

    20-25 question quiz (Appendix E) related to clinical skills based upon a nursing

    textbook used in the undergraduate program, specific to the skills identified by clinical

    faculty as a priority, and the questions will correlate with the educational information

    used in the QR codes. The quiz will be administered pre/post, then graded/scored on a

    % scale out of 100. Scores will be compared pre/post for any change.

- **RQ2 (Technology Use Perceptions)** will be answered by asking qualitative questions to faculty and students. First, nursing faculty will answer questions in the Faculty Focus Groups (Appendix B) prior to the educational intervention; and secondly, the nursing students will answer questions (Appendix C) following the educational intervention. A summary of these results will be provided. In addition, aggregate results will be shared regarding the number of times the QR codes have been scanned to view at usage in the clinical setting. QRCode Studio© will be used to collect this usage data.

- **RQ3 (Anxiety)** will be answered pre/post the educational intervention by the 6-question State Trait Anxiety Inventory (STAI) (Appendix F; Marteau & Bekker, 1992; short version). The tool uses a 4-point Likert type scale ranging from 1 to 4 (with some reverse coding), whereas a higher score for positive feeling questions depicts lower anxiety levels and a higher score for the negative feeling questions depicts higher anxiety. Permission request to use tool was sent and pending.

- **RQ4 (Self-Efficacy)** will be answered pre/post the educational intervention by the 10-question General Self-Efficacy (GSE) tool (Appendix D; Ralf Schwarzer & Matthias Jerusalem, 1995). The tool uses a 4-point Likert scale, whereas a higher score depicts higher levels of students' self-efficacy, which is good. Permission was granted to use GSE tool with appropriate recognition.

- In addition, there are several end-of-course student evaluation survey questions by the School of Nursing that broadly relate to this project. These questions encompass the entire clinical course and are not specific to this project. Descriptive statistics for

aggregate data such as the mean score (scale 1 to 5) will be gathered for the following

questions:

1. "My instructor assisted me in transferring classroom theory to clinical practice"

2. "The course increased my capacity to make clinical decisions."

3. "The clinical setting provided a climate conducive to learning"

In conclusion, the results of this research study have the potential to increase

knowledge, decrease anxiety and increase self-efficacy of nursing students in patient care

clinicals. By integrating mobile technology education in clinicals, this may have the potential

to better connect the theory learned in the classroom to the actual patient care performed at the

bedside. If nursing students can improve their knowledge, skills, anxiety levels, and self-

efficacy, this may better support their transition to professional practicing nurses in the

healthcare environment while improving patient safety.

E. Knowledge Dissemination

Dissemination of the results will be conducted locally through a poster presentation at the

CTL sponsored event for SOTL awardees. State level dissemination is planned for a nursing

organization such as the North Carolina National League for Nursing including a podium/poster

presentation. National dissemination is planned for a national nursing organization conference

such as the ANIA (American Nursing Informatics Association) including a podium/poster. A

manuscript will be written and submitted to the Journal of Nursing Education or the Journal of

Informatics Nursing.

F. Human Subjects

UNC Charlotte Institutional Review Board (IRB) approval will be obtained prior to study implementation. Consent will be requested from clinical nursing faculty and nursing students.

G. Extramural Funding

Currently, we are not seeking extramural funding for this project.

H. Timeline

SEMESTER	ACTIVITIES PLANNED
Spring 2019	● IRB ● Conduct Faculty Focus Groups ● Analyze qualitative data
Summer 2019	● Create & Prepare QR codes ● Create Knowledge Quiz tool ● Develop Teaching Plan ● Prepare data collection tools
Fall 2019	● Pre-intervention data collection ● Training educational intervention ● Implement educational intervention ● Post-intervention data collection & Analysis ● Abstract and Disseminate

Appendices Table of Contents

Appendix A: Demographics

1. Age

2. Gender

3. Junior or Senior

4. Semester 1 or 2

Appendix B: Faculty Focus Group Questions

1. For your nursing clinical group, what would you want students to have technology access to via scanning a QR code from a smartphone/tablet in regard to procedures/psychomotor skills: (check all that apply)

- Urinary catheter insertion and discontinuation

- Peripheral intravenous insertion and discontinuation

- Phlebotomy

- Sterile dressing change

- Medication: oral, otic, ophthalmic, topical, inhalation

- Medications: parenteral

- Medications: peripheral intravenous fluids, antibiotics, push

- Nasogastric Tube insertion and discontinuation

- Enteral Feeding

- Urine collection

- _____

2. For your nursing clinical group, what would you want students to have technology access to in regard to lab values: (check all that apply)

- CBC

- BMP-CHEM 7

- Electrolytes

- PT/INR/PTT

- Urinalysis

- Troponin

- _____

3. For your nursing clinical group, what other information would you want your students to have

technology access to at the point of patient care from a smartphone/tablet?

- Specialized Assessments

- Medications

- Disease processes

- Medication calculations

- _____

4. Do you feel that using technology such as smartphones/tablets in patient care clinicals, has the

potential to enhance, limit, or has no impact on student learning?

Appendix C: Student Perceptions of Technology Usage in Nursing Education

1. Would you use a drug guide application if it was available in clinicals?

2. Would you use health-nursing-medical related applications in the clinical setting if these were available?

3. Would you use e- textbooks that you could access from a mobile device in clinicals?

4. Do you feel that using technology such as smartphones/tablets in patient care clinicals, has the potential to enhance, limit, or has no impact on student learning?

5. Do you find that using smartphones/tablets in clinical settings increases, decreases, or has no change on your stress levels?

6. "Did the use of smartphone/tablet increase the quality of information available at the point of care?" (Secco, et al., 2013)

7. "Did the use of smartphone/tablets help me learn information that I needed to know to provide safer, patient care?" (Secco, et al., 2013)

Appendix D: General Self-Efficacy (GSE) (Ralf Schwarzer & Matthias Jerusalem, 1995)

Directions to be added "When I am participating in patient care nursing clinicals,

1. I can always manage to solve difficult problems if I try hard enough.

2. If someone opposes me, I can find the means and ways to get what I want.

3. It is easy for me to stick to my aims and accomplish my goals.

4. I am confident that I could deal efficiently with unexpected events.

5. Thanks to my resourcefulness, I know how to handle unforeseen situations.

6. I can solve most problems if I invest the necessary effort.

7. I can remain calm when facing difficulties because I can rely on my coping abilities.

8. When I am confronted with a problem, I can usually find several solutions.

9. If I am in trouble, I can usually think of a solution.

10. I can usually handle whatever comes my way.

- Likert type scale ranging from 1 to 4
  - 1 = Not at all true
  - 2 = Hardly true
  - 3 = Moderately true
  - 4 = Exactly true

Appendix E: Knowledge Quiz

This will be created following nursing clinical faculty focus groups (Author Teresa Gaston is board certified in Nursing Education as well as Nursing Informatics and will assist Lee Ann Kenny in writing the quiz questions to evaluate knowledge ~20-25 questions to administer pre/post related to the specific education information placed in the QR codes). It will be scored on a scale of 100%.

Appendix F: State Trait Anxiety Inventory (STAI) (Short Version; Marteau & Bekker, 1992).

Directions to be added "when performing assessment, and psychomotor nursing skills on patients in clinical,

1. I feel calm (need to reverse code)

2. I am tense

3. I feel upset

4. I am relaxed

5. I feel content

6. I am worried

    - Likert type scale ranging from 1 to 4

        ○ 1 = Not at all

        ○ 2 = Somewhat

        ○ 3 = Moderately

        ○ 4 = Very much

    - Plan to calculate a total STAI score. Numbers 1, 4, and 5 will need to be reverse coded first according to manual directions). Sum all scores and compare pre/post.

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