2011

Student Nurse Perceptions of Effective Medication Administration Education

Lorretta C. Krautscheid

Valorie J. Orton

Lori Chorpenning

Rachel Ryerson

International Journal of Nursing Education Scholarship

Volume 8, *Issue* 1 2011 *Article* 7

Student Nurse Perceptions of Effective Medication Administration Education

Lorretta C. Krautscheid* Valorie J. Orton†

Lori Chorpenning‡ Rachel Ryerson**

*University of Portland, krautsch@up.edu

†University of Portland, vorton@georgefox.edu

‡University of Portland, chorpenn@up.edu

**University of Portland, ryerson@up.edu

Student Nurse Perceptions of Effective Medication Administration Education*

Lorretta C. Krautscheid, Valorie J. Orton, Lori Chorpenning, and Rachel Ryerson

Abstract

Nursing faculty strive to educate students in a manner that prevents errors, promoting quality, patient-centered care. This endeavor is dependent upon meaningful and effective education that incorporates educational experiences reflective of the service sector. Anecdotal reports from clinical faculty and student nurses suggest that academic medication administration education may not optimally prepare students for safe entry into clinical practice. The aim of this phenomenologic qualitative research is to understand student nurse perceptions regarding teaching strategies and learning activities that prepared them for safe medication administration in acute care clinical settings. Focus group interviews resulted in two broad themes that are identified as *Effective Education* and *Gaps in Education*. Within these broad themes, findings revealed that students value faculty demonstrations, peer-learning opportunities, and repetitive practice with timely feedback. Study findings also pointed to educational gaps. Students reported needing to learn communication and conflict resolution strategies that would help them manage real-world interruptions, distractions, and computer generated alerts. Study findings recommend implementing relevant decision-support technology within academic lab learning activities.

KEYWORDS: student nurse, effective education, medication administration, educational instruction

---

*The authors wish to thank the Terry Misener Memorial for funding this research.

Nurse educators aim to provide meaningful, relevant, and effective teaching that prepares students for entry into clinical practice settings. One strategy to determine if academic education is effective and meaningful is to gain insights regarding student nurse successes and challenges as they transfer learning from the academic laboratory to the clinical environment. The aim of this phenomenological research is to understand student nurse perceptions regarding academic teaching strategies and learning activities that prepared them to safely administer medications in acute care clinical settings.

RESEARCH PROBLEM

Anecdotal student reports at the University of Portland, in Portland, Oregon, indicate that current medication administration teaching and evaluation strategies lack sufficient reality compared with clinical practice. In addition, acute care clinical faculty report that students experience frustration as they attempt to apply medication administration concepts in the fast-paced and technologically-rich clinical setting. These anecdotal reports raise questions about the effectiveness of academic education and how to prepare students to safely administer medications in acute care.

Currently in the authors' academic setting, students are educated and evaluated on medication administration competencies in the *Introduction to Professional Practice* course that is taught during first semester upper-division nursing courses (year 3 of the baccalaureate program). Medication administration is one unit within this five credit course that teaches fundamental assessments and skills that are pre-requisites for students to enter the clinical setting. Laboratory activities are designed to mirror the clinical environment and reflect concepts from both Bloom's Taxonomy (1956) and behavioral learning theory (Skinner, 1974). For example, in the *Introduction to Professional Practice* course, faculty present cognitive concepts of safe medication administration via a two-hour lecture. Concurrently, students are enrolled in a pharmacology course, strengthening cognitive concepts of medication administration. Lecture is subsequently followed by two, three-hour laboratories with a faculty-to-student ratio of one to ten. In the laboratory setting, faculty assist students to integrate knowledge, skills, and attitudes associated with safely administering oral, topical, otic, optic, inhaled, and injectable medications. Simulated unit dose medications that closely replicate brand-name medications (Wallcur Practi-meds) are purchased and used for instruction, student practice, and performance assessments.

In the laboratory, students learn and practice safe medication administration using five simulated patients (Laerdal Vital Sim ® manikins), manual medication carts, simulated unit-dose practice medications, and essential medication administration supplies (medicine cups, alcohol wipes, syringes, prefilled cartridges, such as carpujects, that load into syringe holders, etc.). Each simulated patient has a paper medical record, including physician orders, laboratory values, nurse assessment data, and medication administration records. Manual medication carts are stocked with simulated medications; one or two medications per drawer, separated by plastic dividers. Experiential education occurs across the two, three-hour laboratories supplemented with open laboratory times that are supervised by either faculty or teaching assistants (nursing students who have completed two semesters of nursing courses, complete an on-site faculty-developed training program, and are deemed competent to assist with teaching in the academic laboratory).

One week after the second three-hour laboratory session, students are tested on safe medication administration. Upon arriving for testing, the student is randomly assigned to demonstrate medication administration to one of the five patients in the laboratory. Each testing scenario lasts 20 minutes and is structured so that students demonstrate both oral and injectable medication administration to their assigned simulated patient. One faculty member directly observes one student at a time and determines entry-level competency based on a faculty-designed performance evaluation instrument consisting of 12 essential competency categories. An excerpt from four sections of the performance assessment tool is shown in Figure 1. Students must achieve a score of 92 out of 100 possible points to pass the laboratory test.

Students who do not pass the medication administration performance assessment are immediately notified of the rationale, requirements for progression, and are required to meet with laboratory faculty for a strengthening session prior to re-testing. Students who are not successful during the second evaluation are required to repeat the entire *Introduction to Professional Practice* course and are not permitted to enter clinical practice until the course is successfully completed. While academic faculty believe that teaching strategies and learning activities replicate clinical practice, this supposition needs to be studied and evaluated to compare faculty perceptions with students lived experiences.

DOI: 10.2202/1548-923X.2178

PROCEDURE: Medication Administration (100 points possible)	**Faculty Comments**
1. ❑ Appropriate clinical attire per student handbook **(3 pts)** ❑ Compare physician order with medication administration record (MAR) **(3 pts)** ❑ Verify allergies and intake status **(3 pts)**	
2. Provide information about the medications that will be given: ❑ Therapeutic effect of medications for this patient **(1 pt)** ❑ Relate each medication with client diagnoses **(1 pt)** ❑ Determine assessments that need to be done. **(2 pt)** Faculty to provide assessment data when student specifically asks; i.e. if student asks, "what is the patient's BP?", then provide student with the BP value. ❑ Interpret client assessment data and determine if medication is appropriate at this time for this client **(3 pt)**	❑ auto fail if essential assessment items are not determined, causing the patient to be medicated inappropriately
3. ❑ Wash hands. Assemble appropriate supplies needed to medicate the client, including selecting the appropriate needle and syringe for the injection **(2 pts)** ❑ Select correct medications from medication cart and calculate dose accurately as needed **(9 pts)** ❑ Compare unit-dose medication label with MAR to verify drug name, dosage, frequency/time, route, and expiration date **(5 pts)**	
4. ❑ Perform routine "room entry" actions; i.e. state nurses name, write nurse name on white board, identify client with two pieces of information, raise the bed to appropriate height, wash hands in patient room **(9 pts)** (Faculty note: each item must be done without hinting to the student. If the item is not done, they do not earn the 9 points. These items are not new and should be integrated into their practice at this level in the curriculum). ❑ Check for medication allergy band **(3 pts)** ❑ Educate client about medications **(2 pt)** ❑ Determine clients' swallowing status and preference for taking medications **(1 pt)**	

Figure 1. Excerpt of Medication Administration Performance Assessment

The need for this study is further supported by the reported number of student medication errors among the graduating 2010 cohort (n=224) at the authors' academic institution. Among the 2010 cohort (who had experienced five consecutive 16 week semesters of nursing courses), a total of twenty-one medication errors were documented. Currently, there is no mechanism in place to document near-miss student medication errors, i.e. medication errors that did not reach the patient because either the clinical faculty or a staff nurse caught the errors and redirected the student. Student and faculty written comments on four of the 21 documented medication errors reveal a direct connection between the student not knowing how to use medication technology in the clinical setting and the resulting error. This data suggests that currently nursing educators may not

optimally educate or evaluate the students' readiness to safely administer medications in acute care clinical settings, contributing to the need to explore student nurse perceptions of effective teaching that promotes transfer of learning.

LITERATURE REVIEW

A systematic review of the literature was conducted via the Cumulative Index to Nursing and Allied Health Literature (CINAHL), EBSCOhost, ProQuest, and Google Scholar databases. The search was conducted using the following key terms: student, nurse, effective education, medication safety, medication errors, work arounds, and student perceptions. The literature reports that among practicing nurses, medication errors are most likely to occur during both the prescribing and administration stages (Barker, Flynn, Pepper, Bates, & Mikeal, 2002; Durham & Alden, 2007). Additionally, among nursing students, the most common medication errors relate to omission, wrong time, wrong dose, mathematical computation errors, inexperience, and distractions (Barker, et al., 2002; O'Shea, 1999; Wolf, Hicks, & Serembus, 2006).

The literature informed faculty members about types of medication errors among practicing nurses and student nurses. Missing in the literature is student nurse perceptions regarding academic education teaching strategies and learning activities that prepared students to safely transfer learning into the acute care clinical environment.

METHODOLOGY

The purpose of this qualitative research study was to explore the students' perspectives and lived experiences with transferability of medication administration knowledge and skills from the academic simulated clinical environment to clinical practice settings. The primary research question was, "How do second semester nursing students perceive the effectiveness of medication administration education as it relates to their lived-experiences administering medications in acute care clinical settings?" A phenomenological research design was used. Phenomenology seeks to provide a rich and in-depth understanding of participant's lived experiences and to describe life events as they occur, not as they are perceived to occur (Creswell, 2008; Polit & Beck, 2004).

Focus groups were used as the method to gather data since this approach provides a wide range of opinions and perspectives. Plummer-D'Amato (2008) reports that focus group methodology offers a qualitative design that elicits a

range of experiences centered on a specific topic in a format that allows participants to respond, react, generate ideas, and provide rationales for their thinking. The aim of focus group qualitative research is to seek a deep, rich understanding of the human perspective on topics that have not previously been explored.

A purposive sample of second-semester nursing students enrolled in a medical-surgical course at the University of Portland's baccalaureate program was emailed an invitation to participate. Institutional Review Board (IRB) approval from the authors' academic institution was obtained as was participant consent (n=13). Ten participants were female and three were male. Participant ages ranged from 20 to 32. No financial or grade incentives were offered for participation. Three 90-minute focus group sessions were held. Interviews were conducted during the first two to three weeks of the students' medical-surgical acute care clinical experience, approximately six weeks after the students participated in medication administration education in the laboratory. A researcher-developed interview protocol was used to systematically guide focus group conversations. Interviews were recorded and later transcribed verbatim.

Researchers reviewed the transcribed data independently. The text was divided into segments of information, labeled as codes, condensed for redundancy, and then developed into themes (Cresswell, 2008). The researchers then met to discuss findings, corroborate evidence, and arrive at themes. Two study participants volunteered to conduct member checking; i.e. students read and provided input on the accuracy of findings.

FINDINGS

Effective Education

Participants described *Effective Education* components within the current curriculum; i.e. education that was perceived by participants to transfer easily into the clinical setting and promote safe medication administration. Within this broad theme, sub-themes that emerged from the transcripts included *Learning how to, Faculty role-modeling,* and *Peer learning with practice*. These themes emerged in response to the broad question, "reflect back to your medication education at the University. What aspects of your education helped you to safely administer medications in the clinical environment?"

Learning how to. Research participants reported that academic medication administration education prepared them for how to safely administer

medications. Students report that both lecture and laboratory taught them how to find information in drug guides, perform six rights of safe medication administration (Harkreader, Hogan, & Thobaben, 2007), determine what assessments to do prior to medication administration, question orders, and how to give injections.

> A positive thing that I learned in lab was how to give injections. I felt really successful giving my very first subcutaneous injection to a live patient. I was very nervous prior to it, but once I got all the materials, went into the room and sat down right next to them, all of a sudden I was straight back into my surroundings, like I was in lab and it was very routine to me and I wasn't nervous at all at that point, I felt very confident.

This participant's comment reflects effective education that is grounded in behavioral learning theory. Specifically, behavioral learning theory suggests that students who learn skills and gain psychomotor precision have the ability to apply knowledge in diverse and unfamiliar situations (Billings & Halstead, 2009; DeYoung, 2003; Reilly & Oermann, 1999). Precision is optimized through structured learning activities and facilitated practice opportunities that reflect real-world problems (Bransford, Brown, & Cocking, 1999). Students who have achieved precision are less likely to have competing factors interfering with working memory and therefore, may focus on cognitive aspects, such as interpreting assessment findings prior to medication administration.

Faculty role-modeling. Participants described the importance of observing faculty perform the steps of safe medication administration during structured academic laboratories. Specifically, students valued the teacher as an expert who models an image of what safe nursing practice will look like.

> Definitely, going through the lab and being shown how to do things by my teacher is really, really important.

> I've been able to nail the required assessments and drug interactions, so that's gone really well. It's even been noticed and that's been written on my clinical evaluation, so, that's huge. The lab instructor showed me that and it was a huge part of what was required of us in lab.

These participants' comments highlight the importance of integrating faculty demonstrations as a teaching strategy. Faculty who role-model clinical practice, facilitate, and redirect student performance, deliver an image of

"someone who has developed expertise and cares about knowledge and learning" (DeYoung, 2003, p. 114). Role-modeling is also grounded in behavioral learning theory, and supported by Bandura (1986) as an observational learning activity. Following observation of an expert, the literature supports both independent and facilitated practice so that observed patterns may be rehearsed and retained (Billings & Halstead, 2009).

Peer learning with practice In addition to faculty role-modeling, peer learning with practice were reported as equally essential for constructing personal patterns of knowing that promote safe medication preparation and administration. Among study participants, peer-learning with practice was frequently reported and occurred during open laboratory sessions.

> In the open lab, especially going through the motions repetitively with peers watching and having their feedback was helpful….they pick up on things or have insights.

Participants consistently voiced the importance of times when the laboratory was reserved for independent student practice and staffed by faculty or teaching assistants. The purpose of open laboratory is for students to rehearse and refine their skills, progressing along psychomotor domain levels from imitation to precision (Bloom, 1956; Billings & Halstead, 2009; Reilly & Oermann, 1999). Peer learning actively engages students in constructing their own knowledge with regard to why they are doing what they are doing. Bandura's (1986) description of observational learning theory and the effects of peer-learning on inhibition, disinhibition, and facilitation of behavior were noted among participant interviews.

> Open lab time was precious lab time. You would be in there with other students who might have heard something a little bit different or their instructor had emphasized something a little bit different. It totally just clarifies the concept or rationale behind something.

Gaps in Education

Participant interviews provided insight into the broad theme of *Gaps in Education*. This theme emerged in response to the broad question, "Reflect back to your medication administration education at the University. Now that you have been in clinical, what was missing from your education that you think would have helped to optimally prepare you for safe medication administration?" Within this broad theme, two sub-themes emerged, reflecting gaps between

academic laboratory education and clinical practice. The first and most common theme is *Teach me relevant technology*. The second theme is related, and is coded as *Prepare me for the real-world*.

Teach me relevant technology. Study participants report that manual medication carts in the academic laboratory are outdated and do not replicate decision-support technology found in acute care clinical settings. Specifically, participants voiced confusion, frustration, and fumbling as they attempted to transfer medication administration knowledge and skills from the academic laboratory to acute-care clinical practice environments where electronic medication dispensing systems (Pyxis) are utilized.

> Lab was just different because we didn't practice with a Pyxis and now that we're on computers, it's so different. A lot of time, we don't really do the safety checks like we did it in lab.

> I was more nervous about getting inside the Pyxis than I was about giving the Heparin – the lab had prepared me for that. The drawers start opening [on the Pyxis], and that's kind of your second check, and then when giving the patient's bedside medications, that's the third check, I believe.

> You're already in a new situation, so when you have to adjust everything for something new, it just throws you for a loop. You want to be calm and prepared and look confident for your patient and your clinical instructor, but when you're in a new situation you have to really think through things so your brain might not be functioning at its best if you're under stress.

Similar participant comments were pervasive throughout focus group interviews and reflect gaps between academic education and acute care clinical practice. Study participants who had previously achieved psychomotor precision in the academic laboratory, as determined by passing the laboratory assessment, reported clinical behaviors that are more consistent with lower psychomotor levels of imitation or manipulation (Billings & Halstead, 2009; Reilly & Oermann, 1999).

> I felt really, like we really were prepared if we were going in with the med cart. But with the addition of adding Pyxis to the equation, we had to relearn, learn how to adjust our safety checks and, you know, just figure it out.

> The computer technique [was a challenge]. So you go into the room and you to have to set up your computer, scan them, scan your meds, and doing that was kind of …I was flustered because it's nothing like I've done before.

Realistic medication administration learning activities that closely mirror clinical practice settings should initially occur in the safe, academic learning environment. These activities should be experiential, purposeful, and provide opportunities for formative feedback followed by summative evaluation to determine novice level competency (Benner, Tanner & Chelsea, 2009). Outdated teaching strategies that utilize static medication dispensing systems and paper charting do not optimally prepare students for today's fast-paced and technolog-rich clinical practice environment.

Students should demonstrate entry-level competency on health care technologies that are relevant for the clinical settings where they will be expected to practice. Performance assessments should "duplicate the natural situation in which the learning will later be used" (Gronlund & Waugh, 2009, p. 151). Participants in this study echo these comments, reporting that in addition to learning medication administration with relevant technology, they strongly encourage updating academic learning activities so that they reflect real-world issues.

Prepare me for the real-world. Acute care clinical settings are complex, challenging, and dynamic. In contrast, academic nursing laboratories are controlled, limiting both distractions and interruptions in student learning. Participants in this study report that while it is important to first learn and become competent with the knowledge and skills required for safe medication administration, it is equally important to learn how to manage distractions and interruptions prior to entering into the clinical environment.

> Here in the hospital setting, I feel like I am caught off guard and I have interruptions and, you know, different things are constantly happening and lots of people are bustling around. It would be extremely beneficial to have that happen in lab.

> Yeah, especially when you have three RN's standing behind you [waiting for the Pyxis]!

> It's almost inevitable that you're going to be pulling meds and maybe when you get in there [medication room], there's nobody in the room but

> it seems like a magical principle that once you enter in your name in the Pyxis, three people automatically pop up behind you and – almost like clockwork. You're trying to focus, make sure that you're checking each med, make sure that you push the right button so you don't cause a problem, and it's not only distracting just to see them there, but they also make comments, you know, "Look at you, I remember when I was a student nurse, how cute!" When you're trying to focus and concentrate they're trying to talk. Intelligence goes down when anxiety increases.

As described by the participants, distractions and information overload in the fast-paced and unpredictable clinical environment contribute to the potential for medication errors (Eisenhauer, Hurley & Dolan, 2007; Pape et al., 2005). "Disractions and information overload more often affect the new nurse or newly employed nurse" (Pape, et al., 2005, p. 109) as they are challenged with thinking about how to operate the equipment while also making clinical judgments.

According to Eisenhauer et al. (2007), medication administration requires cognitive knowledge specifically related to thinking in the moment about dosage, timing, selecting the right medication, assessment, interpretation of assessment data, anticipating risks, patient education and planning for evaluation of medication effectiveness. Each of these clinical judgment actions requires vigilance and critical thinking. Interruptions and distractions during this process are key components contributing to medication errors (Eisenhauer et al., 2007; Fuqua & Stevens, 1988). Findings from this study indicate that academic faculty should not only educate students about how to use relevant medication administration technology, but also how to manage distractions and interruptions so they may focus on principles of safe medication administration.

In addition to learning how to manage real-world distractions and interruptions, participants voiced the importance of learning how to manage alerts embedded in decision support technology. When a nurse scans a patient identification band and then scans a medication packet, the decision support technology embedded in the computer software will either confirm the right dose for the right patient at the right time or, if an issue exists, the program will provide an alert, cueing the nurse to question medication administration. Study participants voiced concern over not knowing that alerts existed, how to resolve them, when to resolve them, and the rationale behind why nurses resolve alerts so quickly.

> I'm still pretty new and inexperienced so those alerts are pretty alerting to me. It kind of sends a mixed message when my clinical instructor [staff

> nurse] is just overriding them or going over them and not really explaining the thought process behind why she could bypass that alert. You know, it could be that there's a perfectly valid reason, I just don't know it and I really would like to know.
>
> The first time it happened, I freaked out. I actually had to connect with, "why I am overriding this?' and, " What is this actually saying?"

Learning how to appropriately use healthcare technology takes time and vigilant formative feedback so that nurses develop knowledge, skills, and attitudes that promote overall safety and effectiveness of the technology (Cronenwett et al., 2007). The Joint Commission (2008), a United States health care regulatory agency, reports that nurses suffer from "alert fatigue"; i.e. if the alert or override option appears too often, clinicians develop a habit of ignoring them. Nursing students are not immune to this phenomenon. In fact, at the authors' institution, faculty reports of student nurse medication errors suggest that students inappropriately select the override option due to a lack of clinical experience and based on behaviors role-modeled by staff nurses in the clinical setting. Implementation of medication technology in the academic laboratory provides an opportunity to purposefully design educational strategies that teach a healthy respect and accountability for the strengths and limitations of technology in healthcare settings. Educating students that technology is dependent upon the critical thinking and values of the operator provides an opportunity to prevent hazardous workarounds.

Government-sponsored and independent reports on medication error rates have identified that errors may be effectively reduced through technology support, such as bar code technology and electronic medication dispensing systems (Patterson, Cook, & Render, 2002; Poon et al., 2006; Sakowski, Newman, & Dozier, 2008; Straight, 2008). The literature effectively demonstrates that electronic medication dispensing systems (EMDS) and associated technology are recommended by credentialing, regulatory, and governmental offices as a strategy to promote safe medication administration, thus, nursing education should include similar technologies in the education of the future nursing workforce.

DISCUSSION

Findings from this study indicate that some components of academic medication administration education, grounded in behavioral learning theory, are perceived by nursing students as *Effective Education*. Specifically, students

perceived faculty role-modeling, repetitive practice, peer feedback, and learning essential medication safety measures in the academic laboratory as education that helped to promote safe medication administration in the clinical setting.

This research also raises to consciousness the need for nursing faculty to solicit student perceptions regarding curricular revisions and innovations that promote relevant and meaningful education. Outdated and non-technologic medication administration systems in the academic laboratory were perceived as *Gaps in Education*. Students reported that their learning and ability to transfer education into the clinical setting would have been improved if they had learned how to use relevant technology, including managing decision support alerts embedded in technology. Finally, students perceived academic education as not real enough, reporting that they need to learn how to manage distractions and interruptions in the laboratory prior to entering acute care practice.

This study focused on baccalaureate students in acute care, medical-surgical clinical settings. Therefore, one identified limitation is that the findings may not resonate with students in long-term care or community clinical settings. Additionally, participant perceptions are based on lived-experiences within the curriculum described in this article. Therefore, while medication administration education is standard across nursing programs, the findings might be limited due to curricular variations.

Study findings provide universal recommendations for nurse educators. Foremost is the recommendation to integrate medication administration technology within academic laboratory teaching strategies and learning activities. The aim of this recommendation is to teach students how to effectively use relevant technology for clinical decisions and to prepare students for acute care practice environments. Specifically, academic laboratories should implement electronic medication dispensing systems (such as Pyxis), bar coded medications, bedside computers with bar code scanners, and embed realistic alerts within computer systems. Realistic academic laboratory activities should provide students with opportunities to develop, practice, and refine knowledge, skills, and attitudes prior to encountering actual patients.

Both real and perceived barriers make this recommendation difficult to achieve. With regard to medication technology, a primary barrier relates to the lack of readily available resources. Medication technology implementation will require financial, human, and time resources. These potential barriers, however, must be carefully considered against the ethical and legal obligations of the nursing program to teach and graduate practice-ready nurses. Curriculum should

be developed in alignment with expected student outcomes and reflect the expectations of current professional nursing practice.

A second recommendation is to purposefully implement real world interruptions and distractions within academic laboratory learning activities. According to the literature, distractions and inadequate knowledge are cited most often as root-causes for medication errors among Registered Nurses (Fuqua & Stevens, 1988; Sears, Goldsworthy & Goodman, 2010; The Joint Commission, 2008; Wolf, et al., 2006). Integrating planned interruptions within academic laboratory activities should occur during the second, three-hour laboratory rather than the first laboratory. Placement in the second laboratory is preferable because students should first attain cognitive knowledge and develop psychomotor manipulation prior to layering on affective domain challenges associated with interruptions and distractions (Anderson & Krathwohl, 2001; Bloom, 1956; Billings & Halstead, 2009; Krathwohl, 1994). Nurse educators should design cognitive and affective learning activities that utilize both communication and conflict management strategies to help students learn how to reduce or eliminate distractions while they are preparing medications.

Findings from this study raise recommendations for future research. In addition to understanding student perceptions, clinical faculty and staff nurse perceptions should also be studied to gain further insights about educational preparation and its impact on student nurse clinical performance. Clinical faculty and staff nurse perceptions regarding near-miss medication errors and causative factors should also be researched to further understand how the curriculum is preparing students for entry into practice. A final research suggestion is to implement recommendations from this study within academic laboratories and repeat the study with nursing students who experienced the revised curriculum.

This study provides evidence to support effective medication administration education within pre-licensure nursing programs. Aims of the educational instruction may be implemented from the viewpoint of behavioral learning theory and should be directed at all domains of learning. In addition to teaching medication administration safety concepts, providing faculty role-modeling, peer learning, and opportunities for rehearsal, faculty should also teach students how to manage and resolve alerts, manage real-world distractions, and appropriately use relevant decision-support technology with the aim of promoting safe medication administration.

REFERENCES

Anderson, L., & Krathwohl, D. (2001). *A taxonomy for learning, teaching and assessing*. New York, NY: Addison Wesley Longman.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Barker, K., Flynn, E., Pepper, G., Bates, D., & Mikeal, R. (2002). Medication errors observed in 36 health care facilities. *Archives of Internal Medicine, 162*, 1897-1903.

Benner, P., Tanner, C., & Chelsea, C. (2009). *Expertise in nursing practice: Caring, clinical judgment, and ethics*. New York, NY: Springer.

Billings, D.M., & Halstead, J.A. (2009). *Teaching in nursing: A guide for faculty* St.Louis, MO: Elsevier.

Bloom, B.S. (1956). *Taxonomy of educational objectives*. New York, NY: Longman.

Bransford, J., Brown, A., & Cocking, R. (1999). *How people learn. Brain, mind, experience, and school*. Washington DC: National Academy Press.

Creswell, J. (2008). *Educational research*. Columbus, OH: Pearson.

Cronenwett, L., Sherwood, G., Barnsteiner, J., Disch, J., Johnson, J., Mitchell, P., …Warren, J. (2007). Quality and safety education for nurses. *Nursing Outlook, 55* (3), 122-131. doi:10.1016/j.outlook.2007.02.006.

DeYoung, S. (2003). *Teaching strategies for nurse educators*. Upper Saddle River, NJ:Prentice Hall.

Durham, C., & Alden, K. (2007). *Enhancing patient safety in nursing education through patient simulation*. Retrieved from: http://www.ahrq.gov/qual/nurseshdbk/docs/durhamc_epsne.pdf

Eisenhauer, L., Hurley, A., & Dolan, N. (2007). Nurses' reported thinking during medication administration. *Journal of Nursing Scholarship, First Quarter 2007*; 82-87. doi:10.1016/j.ijnurstu.2009.05.021.

Fuqua, R., & Stevens, K. (1988). What we know about medication errors: A literature review. *Journal of Nursing Administration*, *3*(1), 1-17.

Gronlund, N., & Waugh, C. (2009). *Assessment of student achievement*. Columbus, OH:Pearson.

Harkreader, H., Hogan, M.A., & Thobaben, M. (2007). *Fundamentals of nursing. Caring and clinical judgment.* St. Louis, MO: Saunders.

Krathwohl, D. (1994). Reflections on the taxonomy: Its past, present and future In L. Anderson & L. Sosniak (Eds). *Bloom's taxonomy, a forty-year restrospective*, (pp.181-200). Chicago, IL: The University of Chicago Press.

O'Shea, E. (1999). Factors contributing to medication errors: a literature review. *Journal of Clinical Nursing*, *8*(5), 496-504. doi: 10.1046/j.1365-2702.1999.00284.x.

Pape, T., Guerra, D., Muzquiz, M., Bryant, J., Ingram, M., Schranner, B. … Welker, J.,(2005). Innovative approaches to reducing nurses' distractions during medication administration. *The Journal of Continuing Education in Nursing*, *36*(3), 108-116. doi: 10.1.1.80.1075.

Patterson, E., Cook, R., & Render, M. (2002). Improving patient safety by identifying side effects from introducing bar coding in medication administration. *Journal of the American Medical Informatics Association*, *9* (5), 540-553. doi:10.1197/jamia.M1061.

Plummer-D'Amato, P. (2008). Focus group methodology part 1: Considerations for design. *International Journal of Therapy and Rehabilitation*, *15* (2), 69-73.

Polit, D., & Beck, C. (2004). *Nursing research. Principles and methods*. New York, NY: Lippincott.

Poon, E., Cina, J., Chuchill, W., Patel, N., Featherstone, E., Rothschild, J. …Ghandi, T. (2006). Medication dispensing errors and potential adverse drug events before and after implementing bar code technology in the pharmacy. *Annals of Internal Medicine*, *145*(6), 426-434.

Reilly, D., & Oermann, M. (1999). *Behavioral objectives: Evaluation in nursing*. New York, NY:National League for Nursing.

Sakowksi, J., Newman, J., & Dozier, K., (2008). Severity of medication administration errors detected by a bar-code medication administration system. *American Journal of Health System Pharmacy*, *65* (17), 1661-1666.

Sears, K., Goldsworthy, S., & Goodman, W. (2010). The relationship between simulation in nursing education and medication safety. *Journal of Nursing Education, 49* (1), 52 -55.

Skinner, B.F. (1974). *About behaviorism*. New York, NY: Vintage Books.

Straight, M. (2008). One strategy to reduce medication errors. *Computers, Informatics, Nursing. January/February 2008*, 23- 30. doi: 10.1097/01.NCN.0000304761.56671.ad

The Joint Commission (2008). *Sentinel event alert: Safely implementing health information and converging technologies.* Retrieved from: http://www.jointcommission.org/SentinelEvents/SentinelEventAlert/sea_42.htm

Wolf, Z., Hicks, R., & Serembus, J (2006). Characteristics of medication errors made by students during the administration phase: A descriptive study. *Journal of Professional Nursing, 22* (1), 39-51. doi:10.1016/j.profnurs.2005.12.008