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Strategies for Optimizing Online Learning in Nursing Staff Education

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Abstract

In the last fifteen years, mandatory nursing education has seen a rapid transition from traditional delivery to online format. The cost benefits, timely dissemination of information, and ease of access are all strong motivators for online distribution of learning. However, wide variations exist in the effectiveness of this educational method. The goals of this project were to determine the elements in online mandatory nursing education that promote learning retention, adherence to practice change, and achievement of target patient outcomes while providing greater learner satisfaction. Using literature review method, this project evaluated published research from 2011 to 2016 on online mandatory education to find the key factors that best achieved the described outcomes. Research findings were evaluated using Adult Learning Theory and the Kirkpatrick evaluation model as theoretical frameworks. Wide differences in study methodology and results reporting limited the ability to determine concrete evidence for recommendations. Interactivity, multimedia, and embedded feedback were all linked to positive learning outcomes. Learner needs and extent of instructor involvement were also considerations in choice of online modalities. Extrinsic factors and organizational support played a role in the successful transition of learning to practice change and achievement of positive patient outcomes. More research, using consistent methodologies, is needed to provide solid best-practice guidelines on the elements that best enable achievement of the desired outcomes in a cost-effective manner.

Keywords: computer-assisted instruction, continuing mandatory education, nursing, educational measurement, health knowledge and attitudes, learning preferences, practice change.

Strategies for Optimizing Online Learning in Nursing Staff Education

Educators in nursing practice development face the daunting task of keeping unit staffs current on education and training. In an ever-changing healthcare world, there is a near constant onslaught of new information requiring attention. Nursing is a 24/7 working environment, with irregularity in shifts and schedules, creating difficulties in providing traditional instruction in a timely and convenient manner. Constantly changing regulatory requirements and practice changes demand a learning format that provides new information in an easily accessed medium. The utilization of online learning modules enables an efficient method of content delivery to help ease the challenge of meeting this constant educational need. Online education provides consistent dissemination of information, allowing for rapid updating in response to relentless regulatory, compliance, equipment, and practice changes (Bindon, 2014). The significant cost benefits, timely dissemination of information, learner-controlled pace of content delivery, and ease of access are all strong motivators for using this learning format (Altimier, 2009; Bindon, 2014; Scholl, 2007).

Unfortunately, wide variations in quality of content delivery and level of learner engagement can diminish the effectiveness of this learning medium. Well-designed online modules, with significant learner interaction, have shown to be equivalent to traditional instruction in promoting behavioral changes in learners (Bindon 2014; Berger, Topp, Davis, Jones, & Stewart, 2009; Rankin, Then, & Attack, 2013). However, poorly designed learning modules, with minimal learner engagement, may serve to satisfy compliance requirements, but fail in imparting any real learning or behavioral change (Mollon et al., 2012; Muir, 2001). While it is the professional responsibility of the registered nurse to maintain competence, engage in lifelong learning, and develop professional practice (American Nurses Credentialing Center

[ANCC], 2012, Foundations for Continuing Nursing Education section, para. 2), educators have a responsibility to present content in a manner that engages the learner and promotes change. However, in this era of reduced reimbursement for healthcare, staff education is often a department that falls victim to budget cuts (Domrose, 2013; Mitchell, 2015). This creates a challenge for educators in providing mandatory content that both promotes information retention and is cost-effective. Mandatory education, those educational topics required to maintain compliance with regulatory agencies, inform staff of policy or practice changes, or introduce new skills or equipment, differs from voluntary continuing education in that the nursing professional has no voice in the topic selection process. In addition, the required training or education may have little or no direct application to the professional nurse's practice. Given the constant flow of required education tasked to the professional nurse, providing a learning modality that meets the learner's needs and provides a positive experience is of paramount importance. This project attempted to determine the most efficient methods of online learning presentation that promotes knowledge retention and practice change for nursing staff needing ongoing education. The following section will describe the purpose of this project.

Purpose of Study

While much research has focused on methods of providing effective online education for degree advancement or voluntary learning, few studies have focused on the needs of learners in response to mandatory education. Mandatory staff education topics may have a huge variability in direct application to the practicing nurse. Though education on equipment or practice changes may have high relevance, corporate compliance topics such as the Stark Law or Medicare Parts C & D may have little to no direct application on the practice of the bedside nurse. Regardless of the applicability of the content to nursing practice, it is imperative that educators consider

utilizing methods that engage audiences and promote retention of learning. While creating highly interactive modules, with content delivery that appeals to every learning style, would be impractical and inefficient, incorporating methods that increase learner engagement will promote retention and application of new knowledge and skills by nursing staff. Therefore, this project sought to answer the question, “What key elements in online mandatory continuing nursing education promote learning retention, adherence to practice change, and achievement of target patient outcomes while providing greater learner satisfaction for registered nursing staff?”

Methods of data collection (described later in the process section) for this project included critical analysis of current research to identify present knowledge regarding five aspects of online mandatory education:

- Factors that promote learner engagement.
- Factors that promote learner satisfaction.
- Suitability of topic for the online learning environment.
- Learning preference accommodation for enhanced understanding.
- Generational considerations in learner demographic.

Nursing and healthcare practices are in constant transformation. Online learning is a viable option for delivering quality staff education, provided the needs of the learner are respected (Phillips, 2005). Evaluating the research, in regards to these five aspects of online education, provided current best practice recommendations for staff educators to create learning modules that meet the educational challenges of our rapidly changing profession.

Significance

As described previously, educators face the continual challenge of keeping nursing staffs current with practice changes. Currently, there are over forty initial and ongoing mandatory education topics that must be covered for acute care staff to meet the 2016 basic regulatory requirements for governmental and accreditation agencies (Missouri Hospital Association, 2016). A review of the 2016 mandatory education requirements for nursing staff at the University of Minnesota Medical Center (UMMC) showed 23 planned educational modules (Vickers, 2016). Some of the topics for the 2016 mandatory education include restraint and seclusion, blood transfusions, copyright infringement, Medicare parts C and D, eye donation, and bariatric sensitivity (Vickers, 2016). A total of seven hours of nursing time is allotted for completion of compliance education in 2016 at the UMMC (Vickers, 2016). This amount does not take into consideration any specialty unit education, nursing practice changes, or equipment and material updates that occur throughout the year.

In looking at the continual need for staff education, it is easy to see why online education or e-learning is chosen to meet this challenge. Online learning reaches a large audience in a relatively short period of time, provides flexibility of access for the learner, reduces non-productive labor costs, accommodates updates in educational materials, promotes consistency in information delivery, and leads to greater learner satisfaction (Altimier, 2009; Bindon, 2014; Elliott & Dillon, 2012; Scholl, 2007). The online format provides just-in-time education, decreasing the delay in dissemination of vital information (Phillips, 2005). Online education reduces units staffing costs by eliminating the need to replace nurses attending traditional lectures (Altimier, 2009). All of these factors promote adoption of e-learning as a viable method of staff education.

Unfortunately, current research is mixed regarding the effectiveness of online learning, versus traditional classroom, in promoting practice change and achieving learner satisfaction (Carcich & Rafti, 2007; Cottrell & Donaldson, 2013; Dumpe, Kanyok, & Hill, 2007; Institute of Medicine, 2010; Mollon, et al., 2012; Pilcher, & Bedford, 2011). However, though this lack of consensus exists, the current trend in healthcare is continued adoption of the e-learning platform to provide staff education and assess competency (Dumpe et al., 2007). Given the variability in research findings, it is imperative to determine what commonalities do exist that positively or negatively affect the success of online education. Maintaining regulatory compliance, ensuring safe patient care, and keeping staff updated on practice changes requires educators to utilize the current best practice to promote efficient and effective online education outcomes for nursing staffs.

This project critically evaluated the last five years of nursing and applicable non-nursing research regarding efficacy of online staff education. Malcolm Knowles Adult Learning Theory (Knowles, 1990) and The New World Kirkpatrick Model (Kirkpatrick & Kirkpatrick, 2015) were chosen as the conceptual frameworks to guide data analysis for the project. Evaluating the current research assists educators in creating modules that engage the adult learner, drive behavioral change, lead to achievement of targeted outcomes, and enhance participant satisfaction while maintaining fiscal responsibility. The following section will describe the relevance of the theoretical frameworks to the problem presented.

Theoretical Frameworks

For this project, I chose to work within the andragogical model of learning. The Association for Nursing Professional Development (ANPD), formerly the National Nursing Staff Development Organization (NNSDO), and American Nurses Association (ANA) base their

practice standards for continuing nursing education on the principles of adult learning, recognizing that "... nursing professional development is a vital phase of lifelong learning in which nurses engage to develop and maintain competence, enhance professional nursing practice, and support achievement of career goals" (ANA & NNSDO, 2010, p. 1). The American Nurses Credentialing Center (ANCC) also supports the adult learning theory framework as basis for creating educational programs that "... are relevant to learners, build on previous learning, and relate to real-world application" (American Nurses Credentialing Center's Commission on Accreditation [ANCCCA], 2012, p. 2). The 2010 Institute of Medicine (IOM) report *Redesigning CE in the Health Professions* further reinforces the embracement of adult learning principles when developing educational programs to tackle gaps in practice, skill, or knowledge in healthcare professionals. Given the emphasis on adult learning theory by these respected agencies, it seemed logical to evaluate the current research regarding effective online mandatory education (OME) using this framework.

However, adherence to adult learning principles in providing effective mandatory education is only one part of the challenge. Optimization of online training programs requires an assessment of the effectiveness of the educational activity in regards to student reaction, retention of learning, promotion of behavioral change, and achievement of desired outcomes (Smidt, Balandin, Sigafos, & Reed, 2009). The Scope and Standards of Practice for Nursing Professional Development (ANA & NNSDO, 2010) supports the systematic evaluation of staff education in regards to attainment of specified outcomes relevant to stakeholders, while also providing program revision guidance for continuous quality improvement. The ANCC further emphasizes the importance of outcome evaluation in terms of how educational programs change nursing practice, are cost-effective, and improve patient care (ANCCCA, 2014). Therefore, the

New World Kirkpatrick Model was also employed to evaluate the current research on effective online mandatory education in regards to level of educational outcome achievement. A description of this evaluation model is found in the second portion of this section.

Adult Learning Theory

Adults, as a target educational population, differ in learning needs, motivations, and lived experiences when compared to children. Learning in childhood is predominantly teacher-focused, with decisions on content inclusion, student learning activities, and assessment of understanding dictated by the instructor (Knowles, 1990; McGrath, 2009). Child learners lack significant life experience, contribute less to the learning process, and predominantly assume a dependent learner role (Knowles, 1990; McGrath, 2009). This approach does not meet the needs of adult students, especially those with significant life experience and seeking occupation-based education that is concise and relevant to their needs (McGrath, 2009). Malcolm Knowles Adult Learning Theory supports this difference in learning need and functions from the basis that "... adults are self-directed and problem-centered, and they need and want to learn useful information that can be readily adapted" (as cited in Candela, 2012, p. 221). New education builds on previous experience, and adult motivation and commitment to learning is enhanced when educational topics are deemed pertinent and applicable to learning needs (Candela, 2012). Knowles identified the following qualities of adult learners (Knowles, 1990; Lieb, 1991; McGrath, 2009; Ross-Gordon, 2011; Taylor & Kroth, 2009):

- *Adults are relevance oriented.* Adults need to know the reasons why the content has value to them and the applicability of the content to real issues of importance. Adult learners are most successful when learning has direct relevance to an identified gap in their knowledge base.

- *Adults are self-directed.* Adults are autonomous learners and prefer instructors serve as facilitators in the educational process. Adult learners resist situations where they assume a dependent learner role and are subject to the will of others.
- *Adults have accumulated a wealth of life experience and knowledge.* Adult learners need to relate new learning to past experiences. Understanding is enhanced when planned educational programs tap into and respect the life experience of the adult learner.
- *Adults are task-centered and prefer learning that has immediate application.* Adults prefer education that clearly describes goals and methods of achievement, as well as identifies how attainment will benefit them in performing tasks or dealing with life or work problems.
- *Adults are motivated to learn.* Adults, whether driven by internal or external forces, are motivated towards continual growth and development. Adult learners may be further motivated when information is directly useful to work or life priorities.

Malcolm Knowles' assumptions regarding the qualities of adult learners are directly applicable to the process of continuing education for successful professional nursing practice. In applying these assumptions for nursing staff education, instruction must be a collaborative experience between students and instructors, demonstrate acknowledgement of the learner's past experience, have clearly defined and logical objectives, and show practical application to the healthcare environment. Awareness and incorporation of the unique qualities of adult learners in developing an educational plan enhances the chances of achieving the desired learning outcomes in nursing staff (Lee & Daugherty, 2016).

The New World Kirkpatrick Model

The New World Kirkpatrick Model is a four-level model of evaluation designed to help determine the effectiveness of an educational program (Bindon, 2014). The Kirkpatrick model, in use for over 50 years, is a popular, well-respected, and classic model for evaluating organizational education and training program effectiveness and value (Bates, 2004; Bindon, 2014; Rouse, 2011). The New World Kirkpatrick Model updates the classic work from 1959, providing a framework for objective evaluation of educational program effectiveness at four outcome levels, and considers the desires of all stakeholders in the learning process (Rouse, 2011). The four levels of program evaluation in the model include *Reaction*, *Learning*, *Behavior*, and *Results*.

The lowest level, *Reaction*, is predominantly concerned about learner satisfaction regarding program delivery in such areas as instructional methods, learning activities, teaching materials, educational setting, and overall learner interest in the program (Bindon, 2014; Rouse, 2011; Smidt et al., 2009). This level attempts to determine the amount of learner engagement in and contributions toward the educational experience, as well as identify the perceived utility of the education in enhancing work performance (Kirkpatrick & Kirkpatrick, 2015). While evaluations at this level gauge learner satisfaction and overall usefulness of the education to the work environment, there is no evaluation of whether participants actually met specified learning objectives.

The second level, *Learning*, ups the evaluation criteria to determine if participants met the defined learning objectives (Rouse, 2011). The level two evaluation determines degree of “... knowledge, skills, attitudes, confidence, and commitment” achieved by participants as a result of the education (Kirkpatrick & Kirkpatrick, 2015, p. 8). Here, outcomes are evaluated as

to how well participants understood the content and/or were able to demonstrate satisfactory performance of learned skills (Smidt et al., 2009). Evaluation methods at this level may include skill performance, written evaluations, pre- and post-test evaluation of learning, role-play, and simulation (Rouse, 2011; Smidt et al., 2009).

The third level looks at the effect of education on *Behavior*. Often this is the endpoint of evaluations that are only concerned with change in individual performance (Clark, Ahten, & Macy, 2014; Rouse, 2001). This level is primarily concerned with how much of the new skills and knowledge were actually applied in the workplace (Rouse, 2011). At this level, reinforcers or barriers may play a part in the success of the behavioral change (Clark et al., 2014; Kirkpatrick & Kirkpatrick, 2015). Successful achievement of behavioral change in the level three evaluation requires more than simply understanding content and demonstrating skill acquisition; learners must also possess the desire to change and work in a climate that promotes and rewards change (Clark et al., 2014; Kirkpatrick & Kirkpatrick, 2015; Rouse, 2011). Conversely, while the training program may be deemed successful at level two, it may fail at level three because the work climate does not encourage practice change, or the learner does not believe the new practice will improve outcomes (Clark et al., 2014; Rouse, 2011). Evaluations at this level consist of chart review, direct observation of learner performance, and participant reflection on changes in workplace behavior (Clark et al., 2014; Rouse, 2009).

The final level of evaluation looks at *Results* of the education in the context of achieving organizational goals and outcomes (Bates, 2004; Bindon, 2014; Rouse, 2014). This level of evaluation looks at whether the implementation of new knowledge led to the desired positive outcome for the unit or organization (Bindon, 2014). Such topics needing high-level evaluation may include improving staff and patient satisfaction, reducing adverse patient events, or

decreasing staff turnover. Here organizations are evaluating how well the education and staff implementation of learning changed unit culture or affected overall organizational performance in a desired area. At the organizational level, this type of high-level evaluation can be time consuming, costly, and complex in implementation, but provides valuable information on the success of the education on achieving change at the system level (Kirkpatrick & Kirkpatrick, 2015). Implementing this final stage of evaluation is beneficial when considering education that promotes practice change, reduces cost, or improves patient outcomes (Smidt et al., 2009). It is at the *Results* stage, where the true assessment of quality improvement can be quantified on a unit or organizational basis.

The New World Kirkpatrick Model provides a useful framework for considering the effect of online mandatory training on imparting positive change in individual, unit, and/or organizational performance outcomes. It is not enough to provide education that adheres to adult learning principles, the effect of the instructional choice must also be evaluated to determine effectiveness and identify variables that may influence adoption of the behavior as part of a new unit or organizational culture. Combining these two theoretical models provides a framework for evaluating research regarding the efficacy of various methods of online learning techniques in respecting the qualities of the adult learner and promotion of change in nursing practice. The following section will define the terms used in the literature review.

Definitions

The Nursing Professional Development Specialist

The nursing professional development (NPD) specialist is a key player in the process of staff development with the goal of providing education that promotes competent nursing practice (Bindon, 2014). These individuals address the spectrum of educational needs for professional

learners and function as change agents within an organization (Swihart, 2009). The NPD specialist, according to the ANA, supports "... nursing research, evidence-based practice, and quality improvement through professional development of direct care nurses and nurse leaders at the point of care" (as cited in Swihart, 2009, para. 4). These individuals are considered learning experts (Bindon, 2014) and participate in all aspects of nursing professional education, from new employee education to annual mandatory competency validation, from practice, documentation, and regulation updates to new equipment orientations, and everything in between.

Learning Management System

The learning management system (LMS) is an online education management program primarily concerned with the logistics of managing web-based educational content (Oakes, 2002). The LMS allows centralized assignment of required learning, serves as a portal to educational content, and enables monitoring of individual participation and performance in learning modules (Dumpe et al., 2007). LMS also provides a record to educators, management, and staff on course due dates and completions (Bindon, 2014).

Training

Training is learning designed to meet a specific objective such as operating a new piece of equipment, learning about a new policy update, or performing a task in a specified manner (Knowles, 1990). The goal of training is mastery of a skill or performance of a task according to a specific routine (Knowles, 1990).

Education

Education is learning designed to promote acquisition of new knowledge to enhance individual potential and promote personal or professional development (Knowles, 1990).

Traditional/ Classroom-based Learning

Traditional or classroom-based learning is the standard lecture and/or discussion format of face-to-face delivery of instruction to a group of people at the same time and place (Carcich & Rafti, 2007).

Online/E-learning

Online or e-learning is the delivery of educational content that is delivered exclusively via electronic or web-based medium (Moore, Dickson-Deane, & Galyen, 2011). E-learning can be synchronous or asynchronous and vary in level of interaction with peers and instructors.

Blended Learning

Blended learning is the integration of online and face-to-face learning in the delivery of instructional content (Altimier, 2009).

Process

The goals of this project were to determine the best methods for enhancing nursing staff knowledge retention and promoting practice change using an online format for mandatory education. Through review of current literature, this project provided guidelines to assist the NPD specialist in selecting online education modalities that enhance knowledge retention and application, increase staff satisfaction with the online learning process, promote practice change, and maintain cost-effectiveness. As mandatory staff education differs from academic in breadth and purpose, the project was limited to evaluating educational needs dictated by a healthcare agency or institution for maintenance of professional competencies. Research studies included for evaluation looked at online nursing staff educational topics such as those required for regulatory or practice changes, unit specific specialty knowledge, equipment upgrades, changes in documentation requirements, or mandatory annual education. These types of educational

topics are required of all nursing staff in the performance of duties and occur frequently and repeatedly throughout the year. Online programs not required of all staff, such as education for specialty certifications or voluntary learning modules, were excluded as educational motivation, knowledge retention, and completion rates may be different.

Search Strategies

A three-pronged strategy was employed to discover literature pertaining to online staff education. In keeping with advice from Fink (2014), The Cochrane Library database was consulted for relevant systematic reviews that may help direct the search. A second step utilized PubMed and the Cumulative Index to Nursing and Allied Health Literature (CINAHL), both described by Dieterle and Hooper-Lane as “...essential” and “...the best starting point for both clinical and research topics in the health sciences” (2014, p. 22). Finally, review of the reference sections contained in each selected article identified further studies to consider. Limiters for all searches included articles printed in English, publication dates of January 1st, 2011 to May 31st, 2016, applicability to subject matter, accessibility of articles. Of specific interest were articles and books addressing the five areas of interest: best methods for information retention, best and least suited topics for online education, accommodations of learning preferences in online environment, generational differences in learning, and staff satisfaction with online education formats. Relevant articles directly addressed one or more of the aspects of interest in the desired subject and met the following inclusion criteria: systematic reviews or meta-analysis of randomized controlled trials (RCTs), well-designed individual RCTs, and pilot studies or trials without randomization and/or control groups. Finally, articles providing expert opinion, based on applicable research, were included for deeper analysis. All queries were completed through

the University of North Dakota Harley E. French Library of the Health Sciences website between May 6th and June 30th, 2016.

The initial search of The Cochrane Library database utilized the following Medical Subject Headings (MeSH): “nursing”, AND “computer-assisted instruction”, AND “clinical competence” and yielded 11 results. A second search using the same first two MeSH terms and adding “continuing education” returned 11 results. A review of the abstracts from each of the initial search results revealed six studies of relevance and one systematic review. Further searches were conducted to find studies or reviews evaluating specific aspects of interest in regards to online mandatory learning for nurses. For these searches, the terms “mandatory education”, “educational measurement”, “health knowledge”, “attitudes”, “practice improvement”, “generational differences”, “satisfaction”, “knowledge retention”, “adult learning theory”, “learning preferences”, “Kirkpatrick model” and “topic selection” and were combined individually with the MeSH terms of “nursing” and “computer-assisted instruction” using the Boolean operator of “AND” to provide 55 total results. Evaluation of returns found eleven studies and one systematic review with direct relevance. Combining all results from The Cochrane Library search gave a total of eleven studies, one systematic review, and one protocol published in the last five years evaluating all or part of the desired aspects of online nursing mandatory education.

The second part of the search process involved using CINAHL and followed the same method of article identification using the MeSH terms, keywords, and Boolean operator applied before. However, for this search, the previous MeSH terms were used as keywords to capture more results. In addition, the only field restriction used was “All text” to capture the greatest amount of results. Finally, CINAHL’s Subject Terms were not incorporated, as they did not

improve the search strength. The same article inclusion criteria used for the Cochrane search was applied to the CINAHL results. This search strategy provided 478 raw results, with many duplicates in the 14 separate searches combining different keywords. A brief review of the abstracts for these results found 29 having direct application to all or part of the aspects in the desired subject.

The final database utilized was PubMed. The same search process and keyword application used in the CINAHL search were again applied. The PubMed search returned 85 articles not identified previously. Of these, twenty-two met evidence criteria and directly addressed subject matter.

Finally, reviewing the reference sections of each selected paper revealed eight articles not previously identified in the previous searches. In all, 64 articles published in nursing journals between January 1st, 2011 and May 31st, 2016 were deemed eligible for final full text evaluation. Three of the initial 64 articles were unobtainable for full text evaluation. Of the remaining 61 articles, 26 were used in this project due to evaluating one or more aspects of interest regarding mandatory nursing education. All excluded articles contained one or more of the following characteristics that necessitated elimination: no evaluation of the e-learning in regards to the aspects of interest for the project, no RNs in the sample of study participants, no use of e-learning as primary modality of delivery, no description of trials predominantly occurring in the last decade (systematic reviews), or no description of interventions related to mandatory education courses. Of those articles meeting final selection, six were systematic reviews, sixteen were RCTs, quasi-experimental before-and-after designs with no control, or descriptive reviews, and four were expert opinions. The wide variety of research quality obtained through the literature search necessitated choosing a hierarchical grading system to guide evaluation of

evidence strength. The following section will describe the evidence grading process used to categorize the literature selected.

Evidence Grading Methodology

The American Association of Critical-Care Nurses (AACN) evidence leveling system was chosen as it accommodated a wide variety of evidence forms. The system, revised in 2009, provides six levels of evidence ranking. The levels are ranked “A” to “E”, with a final level of “M” reserved for manufacturers recommendations only and intentionally separated from alphabetical listing of evidence grades (Armola et al., 2009). The strongest evidence rating, denoted “A”, is reserved for meta-analysis of RCTs that consistently support “... a specific action, intervention, or treatment” (Armola et al., 2009, p. 72). Individual RCTs, meta-analyses with inconsistent results, clinical practice guidelines (CPGs), and expert opinions are rated “B” through “E” respectively. This author chose the AACN system for its clear guidance on ranking decisions and breadth of evidence formats evaluated. A brief summary of findings for each relevant study, along with AACN evidence level, is included within Appendix A of this document and referenced within the appropriate subsections of the literature review that follows.

Review of Literature

The following section describes the general characteristics of included studies or trials used to evaluate the topics of interest. Expert opinions, findings of systematic reviews, or case studies describing program implementation, as well as specific educational interventions and outcome evaluations associated with the described trials and studies listed below, will be included in the applicable subsections of the literature review.

General Characteristics of Included Studies/Trials

Type of study. Nine studies were RCTs with an AACN evidence grading of Level B (Kontio et al., 2013; Kontio, Pitkänen, Joffe, Katajisto, & Välimäki, 2014; Liu, Rong, & Liu, 2014; Maloney et al., 2011; McCrow, Sullivan, & Beattie, 2014; Petty, 2014; Rankin et al., 2013; Sherman, Comer, Putnam, & Freeman, 2012; Smeekens et al., 2011). However, two of the RCTs were published reports evaluating different aspects of the same data (Kontio et al., 2013; Kontio et al., 2014). One RCT was given a Level C designation due to inconsistent results in patient outcomes versus controls (Smith, Stolder, Jaggars, Fang Liu, & Haedtke, 2013). Six studies were given a Level C designation, with one being descriptive (Pilcher & Bedford, 2011), one a prospective study with historical control (Evatt, Ren, Tuite, & Hravnak, 2014), three being prospective before-and-after designs with no control (Mollon et al., 2012; O'Leary, 2011; Schroeder et al., 2016), and one a phenomenological study (Cottrel & Donaldson, 2013).

Country of origin. Studies included for review originated from seven different first-world countries: Taiwan (1) (Liu et al., 2014), the United Kingdom (2) (Cottrel & Donaldson, 2013; Petty, 2014), Canada (1) (Rankin et al., 2013), United States of America (6) (Evatt et al., 2014; Mollon et al., 2012; Pilcher & Bedford, 2011; Schroeder et al., 2016; Sherman et al., 2012; Smith et al., 2013), Australia (3) (Maloney et al., 2011; McCrow et al., 2014; O'Leary, 2011), the Netherlands (1) (Smeekens et al., 2011), and Finland (2) (Kontio et al., 2013; Kontio et al., 2014).

Participant characteristics. Participants in 13 of the 16 studies were predominantly (greater than 75%) or entirely RNs providing direct care in a hospital setting or outpatient center. One study used medical interns and registered nurses as participants (O'Leary, 2012) and two included all healthcare professionals (Maloney et al., 2011; Mollon et al., 2012). All but one

study (Liu et al., 2014) used participants that worked in direct care roles. Studies evaluated interventions in a wide variety of nursing areas, with adult, pediatric, and psychiatric specialties represented. Two studies excluded participants based on educational preparation (Maloney et al., 2011) or years of practice (Petty, 2014). No other studies exclude a specific demographic. However, all studies had a low percentage of male respondents, likely reflecting the gender dominance in nursing. In addition, some measure of demographic characteristics (e.g. age, ethnicity, gender, years of practice, occupation (if applicable), and educational preparation) were reported in all but one of the studies (O' Leary, 2012).

Participant selection. Fourteen of the studies used volunteer participants; however, in the two studies using mandating staff participation in education, the study testing and surveys were voluntary (Mollon et al., 2012; O' Leary, 2012).

Types of education or training. The wide variety of training or education topics included: evidence-based practice application (Mollon et al., 2012), pediatric resuscitation (O' Leary, 2012), delirium (McCrow et al., 2014), restraint and seclusion practices (Kontio et al., 2013; Kontio et al., 2014), blood transfusion (Cottrel & Donaldson, 2013), post-operative pain management (Schroeder et al., 2016), elder depression (Smith, et al., 2013), emergency medicine (Rankin et al., 2013), psychiatric case management (Liu et al., 2014), neonatal nursing (Petty, 2014), and falls prevention (Maloney et al., 2011). Though the educational subjects were diverse, all topics were considered mandatory education due to meeting the following criteria: regularly included in annual mandatory training, traditionally included in compliance education, critical to a practice change implementation, or deemed essential in the care of a specific patient population.

Study size. There was a substantial variation in study sample sizes. The 15 studies had sample sizes ranging from seven (Cottrel & Donaldson, 2013) to over three hundred (Mollon et al., 2012), with a varied distribution within this range

Follow-up periods. Again, follow-up periods were widely variable in the selected studies. Four studies limited follow-up to immediately after intervention (O' Leary, 2012; Petty, 2014; Sherman et al., 2012; Smeekens et. al, 2011). Six studies collected data one to four months after the educational intervention (Liu et al., 2014; Maloney et al., 2011; McCrow et al., 2014; Mollon et al., 2012; Schroeder et al., 2016; Smith et al., 2013) . One study reassessed outcomes at nine months post-intervention (Kontio et al., 2013) and was a follow-up to a previously published trial. Two studies collected data at a single point in time (Cottrel & Donaldson, 2013; Pilcher & Bedford, 2011). One study was non-specific as to the follow-up interval used in evaluating the intervention outcome (Rankin et al., 2013).

The following sections describe included studies that pertain to individual aspects of interest regarding OME. Some of the included trials evaluated several aspects of learning effectiveness and the findings are mentioned in multiple sections of the literature review.

Factors That Promoted Achievement of Patient Outcomes

Five studies looked at the efficacy of OME in achieving target patient outcomes. Smith et al. conducted a yearlong RCT evaluating peer-reviewed CD-based or CD plus instructor-supported programs, versus no intervention, in improving the RN's ability to detect depression in nursing home residents (Smith et al., 2013). Smith et al. found statistically significant ($p < 0.001$) reductions in depression severity among residents assigned to nurses who successfully completed one of the educational interventions (2013). Smith et al. also found that nurses completing the program perceived an overall reduction in depression signs among residents in their care (2013).

Unfortunately, the authors lumped results from both intervention groups (n=24) together and compared the combined data to the control, limiting the usefulness of the research in identifying factors within the two intervention groups that promoted achievement of the desired patient outcomes. In addition, both confirmation bias by RN participants and observer-expectancy effect on resident behavior may have affected the findings in this study. Finally, evaluators in this study were not blinded during the resident chart review portion and this may have biased results, reducing the methodological quality of the study.

A second RCT compared a 120-hour peer-reviewed online course versus a 40-hour traditional training in restraint and seclusion, using a sample size of 195 nurses on ten psychiatric units in Finland (Kontio et al., 2014). While the Kontio et al. study did not find a change in rates of seclusion or restraint use between the intervention and control group, average duration of restraint *time* decreased by 89% on the intervention wards (2014). This study has greater methodological quality due to blinding of researchers to patient outcomes and better comparison factors of intervention versus standard education. However, considering the amount of time devoted to the online program over traditional (120 hours over three months versus 40 hours in five days), it is feasible to conclude that the extensive intervention training may have played a factor in the results.

A third study completed on an orthopedic unit in Pennsylvania used a single group (n=30) pre- and post-test design to evaluate the effect of an online pain management program on patient satisfaction and pain level ratings (Schroeder et al., 2016). While patient pain outcome scores, using a standardized American Pain Society tool, were unchanged, patient satisfaction scores, using the Medicare incentive payment scoring system, improved by 5% (Schroeder et al., 2016). In addition, the Schroeder et al. study found a significant improvement in nausea and

drowsiness reported by patients after the staff education intervention (2016). Unfortunately, a lack of control group limits the quality of the research evidence. In addition, confounding factors, such as use of reminder tags on charting computers and handouts given to nurses, may have affected study outcomes by promoting staff adherence to the new online education.

Rankin et al. conducted a RCT evaluating the effect of an enhanced web-based (n=67) versus a standard web-based (n=65) course on accuracy of RN triage skills in the emergency department (ED) (2013). Participants in the enhanced course completed the same web-based education as the control group; however, learning was augmented using online discussions and workplace projects. A follow-up chart review of patient ED admissions, completed by a RN expert blinded to study participants, noted no change in the two groups in regards to overall triage accuracy (Rankin et al., 2013). However, Rankin et al. did find that the web-enhanced group under triaged patients 80% less than the control group (2013). In terms of patient safety, over triaging is always a safer option due to reduction in delays of care and this cautious approach potentially contributed to better patient outcomes. Unfortunately, in terms of wise use of resources, over triaging tends to increase hospital costs due to inaccurate resource allocation, potentially reducing achievement of organizational financial outcomes.

Liu et al. conducted a RCT evaluating an e-learning program to improve RN case management skills. The authors compared knowledge gains between intervention group (n=100), RNs receiving a five module online education, versus control (n=100) group with no education (2014). Liu et al. compared gains in case management knowledge immediately and three months after intervention (2014). The authors found that the intervention group showed significant knowledge gains at both the immediate and three-month intervals, while the control

group was unchanged (2014). However, as the control group had no education, it would seem reasonable that the intervention group would show comparatively higher gains.

The final study evaluated potential improvements in patient outcomes related to an educational intervention. Smeekens et al. looked at the effect of a peer-reviewed two-hour e-learning program on recognition of child abuse in ED patients (2011). Once again, participants in the control group received no additional education. Comparison of experimental to control groups showed a statistically significant ($p=0.022$) improvement in overall identification of child abuse victims (Smeekens et al., 2011). However, closer inspection of the data revealed only significant improvements in history taking, with all other areas showing no or limited improvement (Smeekens, et al., 2011). While the authors did equate better screening methods to greater identification of child abuse and potentially better patient outcomes (2011), comparing education to no education will likely always skew results in favor of the intervention group and reduce confidence in the efficacy of the intervention method. In addition, a high attrition rate of 36% and small final sample size of 25 (Smeekens et al., 2011) reduced generalization of findings.

While each study, to a varying degree, showed a positive correlation between online education and desired patient outcomes, the heterogeneity of sample sizes, educational format and length, and evaluation criteria significantly limits the strength of this conclusion. This lack of consensus, related to study findings, is similar to the conclusions by Sinclair, Kable, Levett-Jones, and Booth in their systematic review of seven trials, published between 2004 and 2015, evaluating e-learning effectiveness in maintaining clinician competence and improving patient outcomes (2016). Sinclair et al. found the lack of consistency in study methodology, evaluation criteria, and educational quality prevented any generalizations to be made about e-learning

effectiveness in achieving target patient outcomes (2016). In addition, Sinclair et al. cautioned that there is no clear evidence supporting the efficacy of asynchronous learning in promoting positive patient outcomes (2016). The findings of Sinclair et al. and this project indicate that educators should consider whether the online choice would be an effective medium to drive desired patient outcomes.

Unfortunately, for the purposes of this project, the heterogeneity of study designs and implementation methods created a challenge in identifying key elements in OME that consistently promoted successful patient outcomes. In both the Rankin et al. and Kontio et al. (2014) trials, greater interactivity incorporated in the online intervention groups correlated with statistically significant positive patient outcomes (decreased under triaging of patients and reduction of restraint use time respectively). The similarity of these findings, considering the comparable sample sizes, interventions, and evaluation criteria used, indicates a potential relationship. However, the remaining studies discussed in this section have little commonality with each other or the aforementioned trials. Smith et al. did not delineate results based on intervention group (CD only versus CD with instructor support) and the final two studies compared education to no education. Finally, the Schroeder et al. study had added confounding variables such as educational “cheat sheets” and pain assessment reminder cards that may have skewed the results, overestimating the beneficial effect of the online program.

In two studies, having adequate organizational support was considered a factor in the ability of the online intervention to drive positive patient outcomes (Schroeder et al., 2016; Smith et al., 2013). In the Schroeder et al. study, improvement in patient satisfaction scores was partially credited to use of supplementary reminders on the unit encouraging implementation of the new interventions (Schroeder et al., 2016). In contrast, the 59% participant attrition rate

suffered by the Smith et al. study was attributed to poor organizational commitment towards providing time for staff to complete learning (2013). In addition, Smith et al. noted that among the nurses who withdrew from the program, almost all were employed by nursing homes that did not provide paid time to complete the training (2013). The findings of Smith et al. and Schroeder et al. highlighted the effect organizational commitment has on the ability of OME to initiate the drive towards achievement of positive patient outcomes.

Findings from this portion of the literature review indicate that more research is needed to determine what specific attributes of online learning contribute best to achieving target patient and organizational outcomes. More studies, emphasizing homogeneity in trial design and comparing interventions head to head, will give better indications of exactly what qualities best lead to desired organizational or patient outcomes. However, while Sinclair et al. recommended more research on the influence of various e-learning interventions on achieving target outcomes, the authors did note that achieving consensus in this area is unlikely (2016, p. 79).

Given the difficulty in finding studies that showed online education provided consistent and clear attainment of desired patient outcomes (Kirkpatrick Level 4), it seemed reasonable to reduce the level of assessment scrutiny and look at studies that achieved successful practice change.

Factors That Promoted Adherence to Practice Change

As noted by Schroeder et al., “Nurse practice change begins with education and is sustained by nursing management support” (2016, p. 116). Only two studies, one review, and one meta-analysis included from the literature search looked at the efficacy of OME in influencing practice change in healthcare professionals. Evatt et al. evaluated a blended option to improve RN compliance with admission documentation (2014). The authors compared the

effectiveness of a hybrid (online and face-to-face support) intervention over control (online self-learning only) in improving admission documentation rates (2015). Evatt et al. evaluated RN knowledge and attitudes pre- and post-intervention via questionnaire using Likert scale (2015). Objective measurement of practice change (i.e. improvement in RN admission documentation) was conducted on 100 randomly selected patient charts before and after the educational intervention (Evatt et al., 2014). While evaluators completing the chart reviews were not blinded to the project, the analytical capacities of EMRs provide non-biased data on completion rates per documentation item. Results of the hybrid intervention showed statistically significant ($p < 0.001$) improvements in 14 of the 16 documentation areas (Evatt et al., 2014). In addition, RN staff in the hybrid group reported higher self-assessment ratings in both knowledge and attitude post-intervention (Evatt et al., 2014). The authors contributed this improvement in practice change to the blending of online education with face-to-face support to improve understanding (2014). Evatt et al. recommend that, in the case of practice change concerning EMR, learners should be given an opportunity to ask questions and receive individualized instruction to improve understanding and incorporation of the new methods into practice (2014). E-learning that lacks a support process to assist the learner increases chances of misunderstanding due to inability for learners to seek clarification, and this factor raises the risk of new practice abandonment (Rankin, et al., 2013; Sherman et al., 2012).

Maloney et al. conducted an RCT evaluating the ability of a web-based program to replace a traditional skill-based falls reduction program for healthcare professionals (2011). Participants ($n=50$) in the control group attended the standard one day face-to-face program and the intervention group ($n=44$) completed four interactive multimedia learning modules over the course of four weeks (Maloney et al., 2011). Though the intervention group had education

spread over a four-week period, the total instructional time between the groups was the same (Maloney et al., 2011). This study used the Kirkpatrick model to evaluate educational outcomes up to Level 3 (practice change). Maloney et al. found no statistically significant differences between control and intervention groups in regards to perception of practice change (2011). This result is surprising, considering the intervention group had continued reinforcement of the subject matter over four weeks, versus the single-day intervention group. However, the authors only evaluated participants' *perceived* change in practice after completing the program. No objective analysis of staff performance was included to verify that learning, in either modality, had *actually* promoted a practice change. In addition, there was no later follow-up to determine if participants in the intervention modality had maintained the practice change. While an objective Level 3 evaluation is often cost and time prohibitive for organizations (Rouse, 2011), in this case the evaluation would have improved the methodological quality of the study by adding objective data.

Further analysis of articles concerning online education, mandatory or otherwise, and practice change found a lack of research in this area. This finding was concurred by Militello, Gance-Cleveland, Aldrich, and Kamal (2014) in their meta-analysis of online continuing education for healthcare professionals (HCP). The authors evaluated nine systematic reviews, covering almost 500 studies published between 2002 and 2013, and found only 20 percent of the studies evaluated changes in HCP practice after an intervention (Militello et al., 2014). In addition, of those 20 percent, most studies used HCP self-report as the determination of practice change achievement (Militello et al., 2014). The findings from a literature review by Sinclair et al., using seven studies published between 2010 and 2013, concur with the findings of Militello et al., noting that many studies only evaluate intention to change practice versus actual

measurement of behavioral change in reporting findings (2016). Considering both intrinsic and extrinsic factors affect the success of moving from *intention* to *action*, using intention-only as the criteria for determining success in practice change weakens the findings of a study. According to Pilcher, nursing professional development (NPD) specialists need to move beyond using percentage of satisfied participants as the criteria for goal achievement; objective measurement of practice change and the effect of said change on patient outcomes better evaluates the quality on an online educational intervention (2015, p. 59).

Given the lack of recent studies looking at the effect of e-learning on HCP practice change, determining individual characteristics of the learning programs that drove successful change is even more difficult. Although the Evatt et al. study showed that having facilitator support greatly improved compliance with admission documentation, none of the other preceding studies reviewed here mentioned specific interventions in regards to promotion of practice change. While the findings discussed in the following section were considered anecdotal at best, they gave insight into how specific e-learning interventions and approaches may have promoted practice change in learners.

Other factors affecting OME. In the Schroeder et al. pain control study, online education was augmented by placards both given to nurses and placed around the unit promoting the new guidelines for pain assessment and management (2016). While this intervention was not compared to a control, it is conceivable that this daily reinforcement helped augment the online learning and facilitate change in pain evaluation and intervention on the unit.

Kontio et al. (2014) noted that the eLearning course on restraint and seclusion practices placed a much greater emphasis on alternatives to restraint use, versus alternatives to seclusion. The authors surmised that the significant decrease in patient restraint time on the intervention

units, but lack of change in seclusion time, was related to the disproportionate amount of education given to each coercion method (2014). This indicated that learners might tend to adopt practices that receive greater prominence in a learning program. While this is a factor in all learning modalities, an online program with no instructor interaction runs the risk of inadvertently overemphasizing some subjects over others, reducing the utility of the learning program to overall learning on the intended subject.

Rankin et al. found incorporating a workplace project within an online course significantly changed RN triage practices (2013). As discussed earlier, the experiment group showed an 80% improvement in safe triaging of ED patients. This change over standard e-learning in the control group indicated that greater learner involvement might have promoted a change in practice.

While the studies described above only hint at possible interventions that augment online learning, they do indicate that online learning alone is likely insufficient to promote practice change. Other interventions, such as instructor support, greater learner involvement in offline projects, and use of staff reminders may augment online learning and better facilitate successful practice change. Considering the difficulty in finding studies that consistently and objectively met Kirkpatrick Level 3 outcomes, it was necessary to decrease the level of scrutiny again and look for commonalities in online education promoting learning retention (Kirkpatrick Level 2).

Factors that Promoted Learning Retention

The majority of studies included in this project evaluated learning retention based on staff self-report via Likert scale, with only two looking at knowledge gains objectively. McCrow et al., conducted a RCT on the effect of web education in delirium recognition among hospitalized patients in three Australian hospitals (2014). Using a pre-/post-test format with

control, the author compared delirium knowledge and recognition scores between the two groups immediately and two months after the educational intervention (McCrow et al., 2014). The intervention group (n=75) received an online education consisting of best-practice guidelines, hyperlinked facts, and video vignettes on various aspects of delirium identification and management (McCrow et al., 2014). A discussion forum was added to the intervention program to aid in promoting social learning (McCrow et al., 2014). The control group (n=72) received no educational intervention. As expected, the intervention group showed statistically significant ($p<0.001$) gains in both delirium recognition and knowledge over the control group immediately post intervention; but the overall improvement in test scores was only 10% more than the no education group (McCrow et al., 2014). The authors also excluded RNs who had low computer literacy skills (McCrow et al., 2014) and this reduced the generalizability of results. McCrow et al. conducted a second evaluation six to eight weeks after the end of the online intervention, using the same exam, and found that the intervention group scored just seven percent better than the control group at this later timeframe (McCrow et al., 2014). This unexpected lack of knowledge gain, especially considering the use of the same evaluation exam, led McCrow et al. to recommend ongoing interventions to improve retention of content and maintain learning gains (2014).

Kontio et al. conducted a retrospective study on staff knowledge, evaluating the change in competence regarding restraint and seclusion practices nine months after an educational intervention (2013). Specifically, the authors examined if online, versus traditional learning, boosted long-term competence (2013). The authors employed staff self-report, using Likert scale, as the measurement criteria for establishing competence. While the authors expected a consolidation of knowledge and a growth in competence following the initial education, this did

not occur (Kontio et al., 2013). In addition, participants in the intervention group rated their self-efficacy lower than control in regards to restraint and seclusion practices at the nine-month post educational intervention mark (Kontio et al., 2013). Based on their research, the authors concluded that the current online education program be used either as an adjunct to traditional learning or augmented by a synchronous learning component to boost understanding (2013). The authors also recommended adding virtual case studies that were relevant to the patient populations served by the participants to increase interest (Kontio et al., 2013). In analyzing the findings from the 2013 Kontio et al. study, the use of an objective measurement of knowledge gains would have provided data that is more useful. Perceived competence is a less accurate measurement of actual competence, reducing the validity of the authors' study for this project's purposes.

The studies of McCrow et al. and Kontio et al. (2013) provided some insight into limitations of e-learning. However, two studies do not provide basis for general conclusions, and the current research in this area is limited. Lahti et al., in their meta-analysis of e-learning impact on nursing skills and knowledge, found that only 11 of 177 studies evaluated cognitive gains (2014). However, even within the 11 studies, Lahti et al. noted a lack of clear explanation of measurement tools used by the researchers to prove their findings, and this factor limited confident conclusions (2014). Lahti et al. recommended increased emphasis on using consistent and objective evaluations of learner performance to improve research quality regarding e-learning and retention of knowledge (2014). However, even with the absence of clear data in this area, Lahti et al. (2014) concluded that the needs of the learner and the capacities of the online media must be considerations in choosing the appropriate educational format.

Considering the increasing use of online education for mandatory education, evaluating whether the medium is effective in promoting attainment and retention of new learning is paramount.

Factors Promoting Learner Engagement

Three RCTs evaluated learner engagement. While conventional thinking would favor increased learner engagement as a promotor of learning, results were mixed in the research included in this project. The Smith et al. study on nursing home resident depression found that learners in a CD-only program had no greater gains in self-reported perception of improvements in knowledge or skill versus the CD plus instructor supported program (2013). Rankin et al. evaluated the effects of increased learner engagement on triage skills in the emergency department (2013). Both control and experiment groups completed the same web-based training; however, participants in the experiment group also completed a tutorial, participated in online discussions, and conducted a workplace project (Rankin et al., 2013). Rankin et al. concluded that the added interactivity and workplace project aided the in the transfer of learning to application in the workplace (2013).

Petty compared the effect of non-interactive versus interactive e-learning programs on knowledge of neonatal biology for registered nurses (2014). Petty used a pre-/post-test method to compare knowledge gains and participant satisfaction between the two modalities. The non-interactive control group (n=16) were provided text-based only modules, whereas the intervention group (n=15) received interactive modules containing self-testing sections and presenting information in a multimedia format (Petty, 2014). Unlike the majority of studies described in this project, Petty excluded a demographic. In this study, nurses with more than 18 months of neonatal nursing experience were excluded to eliminate this as a confounding variable (Petty, 2014). Participants in this program completed the pre-test, education, and post-test in one

eight-hour period (Petty, 2014). Both modalities showed significant knowledge gains post education; however, there was no significant difference between learning gains in the two groups (Petty, 2014). Petty's findings are inconsistent with previous study's findings supporting interactivity as a promotor of better learning outcomes. While the small sample size limits generalizability, further research using a larger sample size, longer follow-up, and better participant surveys would provide confirming data and may give insight into why the interactive modules were not superior, especially considering active versus passive learning tends to lead to better educational outcomes (Altimier, 2009; Cook et al., 2010; Labeau, 2013; Phillips, 2005).

Given the low study count in the area, the next step was to look at current literature reviews on the subject. An early literature review by Lam-Antoniades, Ratnapalan, and Tait, compared efficacy of flat text versus no intervention and found that, in two of three studies, flat text delivery resulted in no knowledge gains by the participants (2009). This finding, although again not comprehensive enough for generalization, indicates that poor quality online education does not meet learner needs or lead to knowledge gains. The findings of Lam-Antoniades et al. is later supported by Militello et al., who recommended that text not be the primary online delivery method (2014). Militello et al. also supported the use of multimedia and interactive online education to provide the most impact on knowledge gains (2014). Labeau's literature review of five articles on interactive e-learning found a positive correlation between high interactivity in online learning and knowledge gains, and attributed this to greater inclusion of learning styles (2013). Online modules providing high levels of interactivity promote active versus passive learning, engage higher-order thinking, and potentially lead to better educational outcomes (Phillips, 2005). Not only should this approach increase understanding, but it should

also promote better learner satisfaction with the educational process. The following section provides additional insight into achieving learner satisfaction with OME.

Factors That Promoted Learner Satisfaction

The lowest level of Kirkpatrick evaluation entails determination of learner satisfaction. As such, this project attempted to find significant factors that impact staff satisfaction in online learning. Given the time challenges RNs face today, requiring staff to complete learning during the course of the workday can affect satisfaction. Smith et al., in reviewing reasons for the 59% attrition rate among study participants, found two common themes related to lack of completion (2013). First, nurses were not provided time during the workday to complete the education and had competing demands (2013). Second, given the lack of paid time to complete training, nurses who viewed the information as a repeat of prior-learned knowledge felt the education was unnecessary (2013). Rankin et al., in their comparisons of ED training modules, also noted that over half of respondents felt they did not have enough time to complete training during work hours (2013). This led the authors of both studies to recommend employers provide paid time to complete the programs in the future (Rankin et al., 2013; Smith et al., 2013). In contrast, the Kontio et al. study provided participants with 40 hours of paid time to complete the online program (2014). While modules were designed to take 120 hours to finish, 96% of participants completed the voluntary program (Kontio et al., 2014). This may also indicate that paid time to complete education positively affects completion. Cottrell and Donaldson made a similar finding in their phenomenological study, noting that at-work computer access and paid learning time improved satisfaction (2013).

Suitability of Topic for Online Learning Environment

Online learning, though an increasingly popular modality due to its ease of implementation and reduced training costs, may not be a suitable replacement for all RN mandatory education needs.

Online learning for education with psychomotor elements. Only a few studies considered the ability of an online program to replace a traditional program that has a psychomotor component. Considering practical skills need an evaluation method to verify successful performance, the challenge of receiving appropriate feedback complicates the transfer of a traditional course to online format (Maloney et al., 2011). One pilot study used a single group before and after method to explore the efficacy of a two-hour online pediatric cardiopulmonary resuscitation (CPR) refresher course in improving knowledge and skills performance for emergency nurses and physicians (O' Leary, 2012). This study, conducted in an emergency department in Sydney, Australia, evaluated changes in cognitive and psychomotor CPR skills before and after intervention using a sample size of 56 (O' Leary, 2012). While the author found a statistically significant ($p<0.001$) improvement in overall basic and advanced life support performance on a mannequin, closer inspection of the individual outcome measures showed only the areas of rhythm recognition, time to pulse check, and time to first defibrillation actually improved (O' Leary, 2012). In addition, 37 of the 56 participants needed retesting to achieve a passing rating and this could have skewed results in favor of the intervention, as participants may have used more traditional review methods prior to retesting. Finally, considering 93% of participants had previous traditional training, this prior learning may have led to a higher positive result for the intervention. Nonetheless, given the high confidence interval relative to sample size and the traditionally interactive nature of CPR education, this

study showed that an online-only approach might be an effective method to maintain skills between recertification periods.

The Smeekens et al. study on child abuse detection also found improvements in nurses' skill in detecting child abuse victims. However, as described earlier, this study did not compare online intervention to traditional education, limiting usefulness of the results. In addition, closer inspection of the data revealed the only statistically significant gains were in history-taking ability (Smeekens et al., 2011). Given that this is less of a psychomotor skill than assessment, the findings again limit generalizability. Conversely, authors in the Maloney et al. study found statistically similar results between traditional and online modalities in regards to knowledge attainment, satisfaction, and practice change in a falls prevention program with high psychomotor elements (2011). However, this education program used extensive video evaluation of learner skills to compensate for the online environment (Maloney et al., 2011).

Du et al., in their literature review of nine RCT published between 2006 and 2011, found convincing evidence that web-based learning may be equivalent to superior in providing knowledge training, but was less able to provide equal or superior skill training for nurses (2013). Lahti et al. support this finding, in their review of four studies on the subject published between 2007 and 2010 (2014). While the authors here found no significant differences between traditional and online modalities in terms of efficacy in skill promotion, they did recommended a blended approach to ensure transfer of nursing skills to the clinical setting (Lahti et al., 2014).

While results of this project in regards to skill training and online education is inconclusive, in general, online education likely has best effect with courses that are predominantly theory-based and less reliant on instructor verification of skill development (Ray

& Berger, 2010). Programs dealing with skill acquisition may still require a traditional component for return demonstration of performance.

Online learning and unfamiliar topics. Mollon et al., using a descriptive pre- and post-design, looked at improvements in RN use of evidence-based practice (EBP) after online learning (2012). Surveys, using a validated questionnaire and Likert scaling, were given pre- and post-education, asking nurses to self-report their knowledge, skills, and attitudes regarding EBP (Mollon et al., 2012). Mollon et al. found no statistically significant (p value ranging from 0.585 to 0.741) self-reported improvements in knowledge, skill, or attitude regarding use of EBP after education (2012). However, in looking at the educational backgrounds of participants, there was a positive correlation between having a graduate degree and using EBP (p values of <0.01 to <0.05). Mollon et al. surmised that prior experience with EBP, via formal instruction and practical use, likely improved the RN's understanding of the online content (2012). These findings led Mollon et al. to oppose adoption of online self-learning modules as initial education in EBP, in favor of a more interactive, instructor-led course (2012). However, no attempt is made by Mollon et al. to evaluate staff satisfaction with the content provided in the online modules, nor is there any description of the level of interactivity or learning preference accommodations made by the program. Perhaps, lack of interactivity and instructor feedback, given the novel subject matter, contributed to the poor skill and knowledge gains. Chang's literature review also supported this premise, noting that regular feedback and interactivity have a positive correlation on learner understanding, competency, and ability to meet educational objectives (2016).

Learning Preference Accommodation for Enhanced Understanding

Learning style accommodation is considered a valid predictor of success (Kolb as cited in Labeau, 2013, p. 169) and it is reasonable to extend this premise to online education. Cottrell and Donaldson evaluated the ability of an online blood transfusion training program to accommodate learning style preferences of RNs using a semi-structured interview method for their phenomenological study (2013). Participants (n=7) evaluated a peer-reviewed, standardized online transfusion-training program in regards to accommodation of individual learning preferences. While the small sample size and study design precludes generalization, participant interviews identified two common themes. All participants felt that use of only one teaching method, versus those that accommodated multiple learning styles, limited their ability to learn new material (Cottrell & Donaldson, 2013). In addition, all believed that assessment was an integral part of the learning process in online education and a promotor for enhanced understanding by allowing learners to review areas of misunderstanding (Cottrell & Donaldson, 2013).

Pilcher and Bedford conducted a descriptive study analyzing learning preferences, via Likert scale questionnaire, of 186 registered nurses in regards to educational topic and learning modality and found that the majority of nurses preferred lecture for continuing education type classes and online for competency and compliance learning (Pilcher & Bedford, 2011). However, in regards to training on new equipment, products, or skills, a demonstration or simulation approach was preferred (Pilcher & Bedford, 2011). In addition, Pilcher and Bedford found that 54.8% of responders preferred kinesthetic learning, followed by visual learning by 24.3% (2011).

The ANCC recommends engaging the learner through tailoring educational programs to match the “...preferred learning styles of the intended audience” (2012, p. 6). Presenting content that appeals to multiple learning preferences allows individualization and accommodates the personal needs of the individual (Sinclair et al., 2016). Equally as important as learning preferences, consideration of the generational make-up of the learner audience can help guide decisions on online presentation.

Generational Considerations in Learner Demographic

Pilcher and Bedford conducted a descriptive study to identify modality preferences among Millennial, Generation X, and Baby Boomer RNs (2011). The authors used Likert scale rating to quantify participant (n=186) willingness to use different learning modalities (Pilcher & Bedford, 2011). Overall, all generations were *willing* to use lecture (91.6%), but most *preferred* lecture to other means (61.6%) if the topics were part of nursing-related continuing education (Pilcher & Bradford, 2011). In addition, 64.2% of all participants preferred classroom interaction to individual learning (Pilcher & Bedford, 2011). However, if given the choice, 64.7% of respondents from all generations preferred compliance or annual safety training to be given online and 50.4% wanted instruction by demonstration or simulation for new equipment and skills training (Pilcher and Bedford, 2011). While not listed by generation, the authors found a statistically significant difference between the generations in regards to willingness to learn with different modalities (Pilcher & Bedford, 2011). Surprisingly, Millennials were more willing to learn in a lecture versus online format when compared to the Generation X or Baby Boomer groups (Pilcher & Bedford, 2011). This finding is surprising considering Millennials are the digital natives and likely best accustomed to the convenience of online delivery. However, the majority of all RNs prefer lecture to online learning and blended to online-only

(Pilcher & Bedford, 2011). Unfortunately, quantitative results of this study, based on generation of learner, were not provided by the authors; this information would have greatly improved the usability of the data in terms of tailoring content delivery to learner group.

A RCT by Sherman et al. (2012), evaluating generational preferences regarding blended online versus traditional lecture, found no statistically significant differences between age and test scores in an online critical care pharmacology program. In addition, Sherman et al. found no significant differences between educational preparation, computer experience, gender, or nursing experience and test performance. However, the authors did note that extensive technological assistance was provided to the learners to mitigate the effects of low computer skills on knowledge gains (2012). Considering this type of support is not always available, cost-effective, or feasible with online mandatory education, the findings of Sherman et al. are limited in practical usefulness.

Considering the two RCTs included in this project provided little insight into generational factors, and there were no recent literature reviews for comparison, a look at expert reviews on the generational differences in online learning was the next step. While expert review is low on the hierarchy at Level E (Armola et al., 2009), this type of non-research evidence does provide some guidelines for the NPD specialist. The generational recommendations offered by expert review were integrated with the study findings in the discussion portion of this project.

Summary of Literature Review Findings

While the vast majority of the findings in this literature review fail to give solid evidence into factors that enhance the effectiveness on OME, this lack of consensus proves that more research is needed to identify the most efficient approach. Most studies evaluated learning at Kirkpatrick Level 1 or 2, and often used participant satisfaction or self-report only as the criteria

for success. Future research needs to use consistency in study methodology, apply objective measurements in evaluation, and increase evaluation scrutiny to discover best-practice methods in delivery of online learning.

Although few generalizations can be made regarding effective OME, the preceding research did give some guidance in improving potential for learner success. Participant satisfaction and motivation is improved when learners are provided paid time to complete education (Cottrell & Donaldson, 2013; Schroeder et al., 2016; Smith et al., 2013). Adding interactive elements positively promotes knowledge acquisition (Labeau, 2013; Militello et al., 2014; Rankin et al., 2013). Using a multimodal approach greater aligns the content delivery to match learner preferences and enhances the learning experience (Cottrell & Donaldson, 2013; Labeau, 2013). Finally, adding instructor support as an adjunct to online learning allows for clarification of concepts to improve understanding and enables feedback for performance improvement (Chang, 2016; Evatt et al., 2014; Rankin et al., 2013; Sherman et al., 2012). All of these elements promote a successful transfer of knowledge from computer screen to practice.

OME also must be evaluated through objective measurement of knowledge gains, versus self-report only. Providing objective measurement, via knowledge or performance testing, gives the learner and instructor feedback regarding successful attainment of cognitive or psychomotor goals and provides insight into the effectiveness of the chosen educational delivery format (Pilcher, 2015). In addition, educational programs with the intent of practice change for better patient or organizational outcomes need to consider other factors that affect the application of knowledge to the workplace (Sinclair et al., 2016).

The findings of the literature review provided insight into the current knowledge regarding components of effective OME for nursing professionals. The following section will

integrate the findings of the literature with the chosen frameworks of Adult Learning theory and the Kirkpatrick Evaluation Model.

Discussion

This project examined the relevant research regarding OME to identify the key elements that best promote retention of new knowledge, incorporation of new learning into practice, and maintenance of new practices in the achievement of positive patient outcomes. However, just as the research was mixed in methods and results, it also showed a variable adherence to the principles of adult learning. This varied respect towards the unique needs and preferences of a diverse professional learner audience has implications on the ability of the OME to achieve the desirable outcomes at the individual, practice, and patient levels.

The research in the previous sections was analyzed in regards to respecting adult learning principles and objective achievement of outcomes. Considering that the unique needs and learning preferences of the adult learner provide the foundation by which higher outcomes are ultimately achieved (Militello et al., 2014), it seemed logical to analyze the research from the point of view of the adult learner, and then consider how the contributions of the each of the five aspects of interest factor into achieving outcomes within the Kirkpatrick hierarchy. Findings of the literature review were integrated with expert opinion to aid in determining what elements from the current published research best promoted achievement of desired outcomes at each evaluation level for OME. Contained within each subsection are recommendations based on the interpretation of the literature and expert reviews. The last portion of the discussion section contains evaluation recommendations and further implications for nursing regarding implementation of effective OME.

Generational Considerations

Currently there are three major (Baby Boomer, Gen X, and Millennial) and two minor (Veteran and Gen Z) generational groups in the nursing workforce (Bell, 2013). The changes in formative educational format experienced among these diverse groups makes tailoring OME to meet their learning needs a challenging proposal. While RNs from the Veteran, Baby-Boomer, and older segments of Generation X transitioned into a computer-dependent workplace, computer experience and technical savvy, rather than age, were found to be the more important factors in comfort with online delivery of education (Broady, Chan, & Caputi, 2008; Paterson, 2010). For example, a high percentage of active nurses from older generations use the internet regularly at home or work for needs (Pilcher & Bedford, 2011). In considering the motivations of the adult learner, the willingness to learn with technology is related more to the perceived benefit of the education and the ease of access versus generational differences (Pilcher & Bradley, 2013). Providing basic computer skills and instruction on accessing and navigating online modules improves learner success with and acceptance of electronically delivered learning (Cheng, 2012; Elliott & Dillion, 2012; Sherman et al., 2012; Sweeney, Saarmann, Flagg, & Seidman, 2008).

Generational recommendations for OME. While tailoring OME, though considerations toward the learning history of the nursing workforce, may better improve understanding and integration of the content presented, all generations may benefit from the following recommendations. Older staff that transitioned from printed educational materials may appreciate the option in online learning as a memory aid (Bell, 2013; Laughlin, 2012; Paterson, 2010). However, all generations appreciate printed educational materials for review (Paterson, 2010). Incorporating printable summaries of information provides a reference and

review for all generations of learners (Lau, 2014). In regards to transitioning courses to online, older generations more accustomed to a traditional format may appreciate face-to-face options to augment online learning (Bell, 2013; Gallo, 2011); however, the Gen X and Millennials, though having lived much longer in a computer-dependent era, may also desire this option for receiving feedback on performance (Bell, 2013). Offering instructor support for complex OME may better acknowledge the unique needs of all generations of learners and improve understanding through clarification of concepts. For all learners, having optional computer training and orientation on using the Learning Management System improves participation and satisfaction with online learning (Sweeney et al., 2008). Incorporating technical support options assists all learners by easing access to online learning and improving content navigation (Bell, 2013; Bindon, 2014; Paterson, 2010). Finally, adding interactive elements and utilizing collaboration is appreciated by all generations to enhance the learning process (Gallo, 2011). Supplementing presentations with videos and providing interactive learning choices, using applicable case studies or relevant problem-based scenarios, appeal to the Gen X and Millennial learning preferences (Gallo, 2011); however, these interventions also provide a useful practical application of learning that appeals to all adult learners. A simple intervention, such as incorporating a discussion board for longer online programs, adds a social learning component and allows nurses to learn from the experiences of others (Bell, 2013; Phillips, 2005). In considering the educational needs of a multigenerational RN workforce, the focus is less on specific interventions for each generation, but more on adult learning interventions that best promote successful education for all.

Learner Preference Accommodation

Just as traditional didactic programs fail to be a student-centered approach, using a passive, dependent process for OME will also potentiate disengagement by the adult learner

(Altimier, 2009; Phillips, 2005; Stout, 2012). Limiting online presentations to one teaching style reduces understanding for learners (Cottrell & Donaldson, 2013). In addition, hastily and poorly designed learning materials, while less time intensive for the instructor, risk learner apathy and poor retention of knowledge (Altimier, 2009; Bindon, 2014; Lam-Antoniades et al., 2009). Active engagement strategies and matching delivery to meet the unique needs of the learner improves effectiveness of the online medium and better appeals to the self-motivated adult learner (Altimier, 2009; Carcich & Rafti, 2007; Phillips, 2005). Finally, allowing the learner group to have a voice in the educational process better embraces a cooperative effort between learner and teacher to meet the needs of the participants (Pilcher & Bedford, 2011) and respects the autonomous nature of the adult learner.

Learner preference recommendations and OME. NPD specialists should consider multimodal content delivery to improve personalization and better accommodate learning needs (Altimier, 2009; Sinclair et al., 2016; Stout, 2013). Avoid static presentations, in favor of those that incorporate greater sensory stimulation to meet the preferences of the learner better (Galbraith & Fouch, 2007; Pilcher and Bedford, 2011). Simply adding audio to existing presentations potentially improves learning by increased sensory stimulation (Cook et al., 2010; Schneiderman, Corbridge, & Johnson-Zerwic, 2009). In the case of complex concepts, providing learner choice in formats through incorporation of text, pictures, video, and/or simulation captures as many learning styles and preferences as possible (Carcich & Rafti, 2007; Labeau, 2013). Embed feedback opportunities within the modules to improve understanding and enhance the learners' ability to gauge achievement towards meeting educational goals (Chang, 2016). Overall, providing OME that has a greater inclusivity of learner preferences and

adaptability to multiple learning styles provides the best opportunity to engage the adult learner via a more personalized learning experience.

Online Learning and Topic Suitability

While online delivery of mandatory education may be an efficient choice, the NPD specialist must make careful decisions on whether the medium is an effective choice for the content presented. Learning programs with a high psychomotor component require feedback to verify correct execution of skills for safe care (Du et al., 2013; Lahti et al., 2014; Maloney et al., 2011). Online learning alone is a poor substitute for initial technical skill training (Berger et al., 2009). However, in situations where the intervention is a review of previously learned materials, using online modules may provide an efficient method to address skill and knowledge degradation between certification periods (Maloney et al., 2011; O'Leary, 2011).

Certain topics have greater success when learners can interact with each other or the instructor in real time. Topics of an ethical or sensitive nature, where learner synthesis and evaluation of content is desirable, may be better suited to a traditional facilitated learning format (Klingbeil, Johnson, Totka, & Doyle, 2009). In regards to the introduction of foreign concepts or procedures to the RN audience, adoption of a more traditional approach may enhance understanding, as instructors are better able to clarify misunderstanding and promote better learning in a real-time environment (Mollon et al., 2012). The introduction of novel information may require the adult learner to adopt a more dependent learner style temporarily, requiring greater effort on the part of the instructor to ensure understanding (McGrath, 2009) and these situations may be challenging in an online delivery format.

Considerations regarding topic selection and OME. As described in the preceding segment, not all educational topics will easily transfer to online delivery; considerations are

needed before attempting to transfer certain types of courses to online. Skill-based OME needs a performance feedback mechanism to verify correct technique (Du et al., 2013; Lahti et al., 2014; Maloney et al., 2011); this type of course may be best served by a blended approach. OME introducing unfamiliar procedures or information will need greater interactivity between instructor and learner (Mollon et al. 2012), an intervention that may be challenging in an asynchronous online program. The cognitive goals of the program need to be considered in adapting the topic to online delivery. While lower-level thinking, using reading or videos, may be suitable for some topics, professional topics that require analysis, synthesis, and evaluation of learning for practice will require high-quality active learning strategies to assist the learner in achieving the educational goal (Phillips, 2005). Due to the time and costs involved, courses needing high levels of interactivity and instructor involvement may still be best suited with face-to-face or blended delivery.

Promoting Learner Satisfaction

The lowest level of Kirkpatrick performance achievement is entirely concerned with the experience of the participant in regards to the learning activity (Kirkpatrick & Kirkpatrick, 2015). While content considerations of and accommodations for the needs of the learner audience, as discussed in the previous sections, are components of learner satisfaction, other factors impact satisfaction as well. As discussed in the review, greater learner satisfaction is associated with dedicated time for learning (Cottrell & Donaldson, 2013; Stout, 2013). OME required to be completed during an already busy workday creates a suboptimal environment for meaningful learning (Bindon, 2014). In addition, some OME, such as those completed to satisfy compliance requirements, may be viewed as having little direct application or relevance to the workplace and risk low attention by the adult learner (McGrath, 2009). The coupling of low

relevancy compliance learning with a noisy and distracted work environment creates low satisfaction learning event. However, satisfaction is improved when learners have a protected learning environment and receive education that is relevant and immediately useful to their place of work (Lehr et al., 2013; Smith et al., 2013).

Recommendations for improving learner satisfaction. In addition to the interventions listed in preceding sections, the NPD specialist should endeavor, when possible, to provide protected time and at-work computer access for learning (Rankin et al., 2013; Smith et al., 2013; Stout, 2013). This approach would reduce work-related interruptions to learning, and may be of special benefit to compliance topics that have limited interest and perceived relevance to the adult learner. If this accommodation is not possible, providing paid time to complete learning during off hours may promote greater satisfaction by allowing RNs to learn in the environment and at the pace of their choosing (Ray & Berger, 2010). Finally, as adult learners prefer content with immediate application and direct relevancy to their needs, customizing the content presented in regards to how it will benefit in solving issues, problems, or practices in the workplace may improve learner satisfaction and attention to the content presented (Galbraith & Fouch, 2007).

Further interventions in OME that promote learner satisfaction are categorized within the applicable subheadings in the final portion of this section. Many interventions, such as increased interactivity and incorporation of multimedia, both provide learner satisfaction and promote improved learning outcomes (Cook et al., 2010).

Promoting Achievement of Learner Engagement and Learning Retention

The second level of the Kirkpatrick evaluation moves beyond participant satisfaction and evaluates the degree at which the learner has acquired the knowledge or skills intended after

participating in the learning event (Kirkpatrick & Kirkpatrick, 2015). Many of the interventions for greater learner engagement also contribute to higher knowledge gains (Militello et al., 2014). Engaging the learner through a multimedia, feedback, and interactive education better meets the needs of diverse learning styles and increases the overall opportunity for deeper understanding (Labeau, 2013; Phillips, 2005). Conversely, low engagement methods, such as text only OME, promote passive, surface learning and results in limited cognitive gains (Lau, 2014; Militello et al., 2014; Phillips, 2005). According to Laird, knowledge retention is best promoted through use of high-quality visual and auditory methods (as cited in Dunn, 2002, p. 1). Higher sensory stimulation leads to long-term storage of information in multiple areas of the brain; a process beneficial for increased recall (Pilcher & Bradley, 2013). Limiting the use of multimedia hampers the learner's ability to use these methods to enhance knowledge acquisition and retention (Dunn, 2002). NPD specialists are wise to consider the desired level of cognitive achievement when making choices regarding interactivity and amount of engagement preferred from the learner audience.

Recommendations to improve learner engagement and learning retention. As before, satisfaction with the learning process needs to be realized before learning retention will be successful (Kirkpatrick, 2015). Interventions at this level are primarily concerned with using engagement methods to reinforce learning. In providing OME with the higher-level learning goals, choose interactive activities that promote application, analysis, and evaluation versus rote memorization (Phillips, 2005; Pilcher & Bradley, 2013). Utilize feedback on performance and imbed easy opportunities to reinforce learning during the online event to enhance motivation to learn via greater engagement (Cook et al., 2010; Phillips, 2005). Incorporate learning methods that stimulate multiple areas of the brain to enhance the chances of retention (Dunn, 2002;

Pilcher & Bradley, 2013). For concepts that benefit from a cooperative learning experience, consider incorporating a social learning component, via discussion boards and synchronous learning events, to boost understanding through the sharing of past experience and knowledge (Cook et al., 2010; Kontio et al., 2013; McCrow et al., 2014). Enhance retention by presenting short packets of new information and relate the information to prior learning (Galbraith & Fouch, 2007; Pilcher & Bradley, 2013). Provide a review and summary section to promote retention through built-in repetition (Lau, 2014). Augment self-report of knowledge gains with objective measurements to provide a more accurate picture of actual understanding and retention of learning (Lahti et al., 2014). Finally, provide periodic reviews of education, after the initial learning event, to reinforce retention of new concepts (Kontio et al., 2013; McCrow et al., 2014). Incorporating these types of interventions into OME delivery provide a better opportunity for the learner to acquire and retain new knowledge and skills in the push towards achievement of practice change.

Promoting Achievement of Practice Change

Practice change (Kirkpatrick Level 3) moves beyond the individual learner and considers other factors that may influence the successful application of learning to practice (Kirkpatrick & Kirkpatrick, 2015). The criteria for success in achievement of practice change are more stringent, evaluating how well the learner applied the learning to individual practice (Pilcher, 2015). Intrinsic motivators alone will not sustain practice change on a unit level (Virani, Lemieux-Charles, & Berta, 2009). Practice change is initiated through education and sustained by processes that support and encourage integration of new learning into daily practice (Kirkpatrick & Kirkpatrick, 2015). Therefore, the interventions needed to achieve this level of accomplishment are also more involved than before. In regards to professional nursing,

achievement of practice change requires: understanding of the rationale behind the new practice and effect of implementation on patient outcomes, identification of workflow barriers that may impede adoption of the new processes, ongoing encouragement and support by leadership and unit champions to sustain change, and bidirectional communication regarding the efficacy of the new practice (Agency for Healthcare Research and Quality [AHRQ], 2014a). Though the available research is limited for interventions at this level (Mollon et al., 2012; Sinclair et al., 2016), a few commonalities were found in the literature reviewed for this project.

Interventions that promote practice change. Providing a face-to-face component to OME enables the opportunity to ask questions and facilitate understanding (Evatt et al., 2014), as well as decreases the risk of practice abandonment (Rankin et al., 2013; Sherman et al., 2012). Augmenting online learning with knowledge reminders at the place of application can positively promote transfer of knowledge to practice (Schroeder et al., 2016). Using workplace projects to move the knowledge from theory to practice increases understanding of how the content can be applied in a practical setting (Rankin et al., 2013). Relating the educational intervention to a current practice gap on the unit that affects patient outcomes increases relevancy of the learning and engages intrinsic motivators (Stout, 2013). Finally, embedding the practice into workflow through reminders and documentation included in the EMR system reinforces new practices (Schroeder et al., 2016; Virani et al., 2009).

Promoting Achievement of Patient Outcomes

The highest level of evaluation looks at the degree to which an educational intervention leads to achievement of targeted organizational outcomes (Kirkpatrick & Kirkpatrick, 2015). In professional nursing practice, targeted organizational outcomes are often patient driven. As discussed in the previous section, OME is frequently the initial intervention in the process

towards practice change and ultimately improved patient outcomes. However, as in practice change, factors outside of the initial educational intervention affect achievement of outcomes at this level (Kirkpatrick & Kirkpatrick, 2015). The challenge is in sustaining the practice change and making it the new unit culture after the initial outside push and stimulus have diminished (Virani et al., 2009). Unfortunately, very few studies have evaluated the effect of OME on patient outcomes and of these, even fewer found conclusive evidence linking specific interventions to successful achievement (Lam-Antoniades et al., 2009; Militello et al., 2014). This gap in research created difficulty in finding practice recommendations for this level.

Recommendations for achievement of patient outcomes. To review, the Kirkpatrick Model is a hierarchical system of evaluation, and as such requires meeting the evaluation criteria of each of the lower levels prior to attaining successful achievement of Level 4. Any prior challenges to practice implementation, namely barriers to practical application, must be resolved before sustained patient outcomes will be achieved (AHRQ, 2014b). Administration must continue to support the new practice through both policy change and resource support (Schroeder et al., 2016; Virani et al., 2009). Adherence to practice change must be encouraged, rewarded, monitored, and reported to keep staff motivated and informed of progress towards outcome achievement (AHRQ, 2014b). Intrinsic motivation must be maintained through relaying how the new practice change has positively affected patient outcomes (Stout, 2013). Finally, regular review and update of the new practice is needed to reflect the continual evolution of nursing care (AHRQ, 2014b; Virani et al., 2009).

Evaluation of Recommendations

While recommendations determined in this project were based on published research and supported by well-accepted theory, current nursing research has yet to establish a strong and

consistent link between the identified interventions and positive outcomes (Cook et al., 2010; Du et al., 2013; Labeau, 2013; Lahti et al., 2014; Militello et al., 2014; Sinclair et al., 2016).

Variables in research design methodology and data reporting reduce the overall confidence that the use of one specific method, over another, in providing OME will promote greater results.

Add into this the innumerable types of nursing care specialties and unit characteristics present today, and determining interventions that will work for every situation, every time, is impossible.

The recommendations provided by this project, in regards to the elements and aspects of interest, maintain respect for the unique needs of the adult learner and use techniques that appeal to a wide variety of learning styles. Though this project was unable to provide concrete evidence of the key elements and aspects in OME delivery that best promote achievement of desired outcomes, evaluation of the relevant research did provide insight into current and future implications for nursing.

Implications for Nursing

Research

The large heterogeneity of study methodologies and results, coupled with the lack of research, hampered the ability to determine best-practice recommendations regarding the characteristics in OME that promote achievement of desired outcomes. More studies, evaluating online modalities head-to-head, will help fill in the gaps on this subject and determine the most efficacious and cost-effective methods. Producing high-quality interactive learning modules requires both a financial and time investment, identifying and using best-practice strategies in modality selection ensures that resources are allocated intelligently (Beattie, Brady, & Tobias, 2013). In regards to assessment of learning and retention in OME modality choice, the vast majority of research has focused on participant satisfaction and self-reported change in

knowledge and practice (Lahti et al., 2014; McCrow et al., 2014; Pilcher, 2015; Sinclair et al., 2016). It is time to add objective evaluation of knowledge gains to better quantify the extent of actual learning (Lahti et al., 2014) and provide a comparison to perceived learning. Finally, it is unwise to assume that factors promoting better participant learning and retention will lead, on their own, to desired practice and patient outcomes. Nursing research must consider how extrinsic factors affect the transfer of OME to practice and how sustainment of that practice affects patient outcomes (Bindon, 2014; Pilcher, 2015; Virani et al., 2009). Looking at the “whole picture” and identifying the effect of all contributors involved, will provide better direction in driving desired patient outcomes via online mandatory education.

Education

The constant evolution in technology has provided an ever-changing bag of tools available to the NPD specialist in creating online learning. The challenges presented by this wealth of interactive options are in choosing the modality that both best suits the target audience and is a wise use of available resources (Beattie et al., 2013). Factors, such as learning preferences, educational backgrounds, and generational composition of the audience, along with appropriateness of topic to online conversion and NPD educator skill in designing e-learning, are all considerations when choosing how mandatory education is delivered (Phillips, 2005). NPD specialists must continue to remain innovative in choosing how best to provide cost-effective OME that meets the learning needs of the target audience (Ray & Berger, 2010). The NNSDO considers proficiency in computerized instruction an essential skill of certified NPD specialists (Bindon, 2014). Achieving competence in the most recent e-learning interventions ensures that the NPD specialist is not limited by skill in choosing the best approach for their learner audience.

Most evaluation of OME is still conducted at Kirkpatrick Level 1. NPD specialists need to up the criteria for assessing success. Participant satisfaction, while integral to the learning process, does not equate to achievement (Pilcher, 2015; Stout, 2013). Looking at the effect of chosen learning interventions in terms of cognitive gains *and* learner satisfaction better informs both the NPD specialist and administration on the value of educational investment.

Practice

As discussed previously, limited research was available that evaluated the effect of specific educational interventions on nursing practice change. However, achievement of practice change does not occur solely through education (Stout, 2013). Outside factors, such as workflow impediments, ease of implementation, and established unit culture are a few examples of extrinsic motivators affecting success at this level. While nurses do have a professional obligation to develop personal practice (ANA & NNSDO, 2010), organizations that actively embrace practice change, through systematic planning and resource support, produce environments that are more receptive to innovations in care (Virani et al., 2009). Modifying workflow processes to ease implementation, using reminders at the point of care, enlisting enthusiastic staff as change agents, being receptive to staff concerns, providing additional financial or personal resources as needed, and rewarding staff for progress in performance all combine with quality education to drive practice change (AHRQ, 2014a; Virani et al, 2009). NPD specialists need to collaborate with nursing staff to determine what unique drivers are needed and barriers are present that may affect the successful transition and maintenance of new knowledge and skill to practice on their units (AHRQ, 2014a). The combination of high-quality OME, thoughtful transition planning, elimination of perceived barriers, and maintenance of driving mechanisms will best promote the conversion of OME to permanent practice.

Policy

As healthcare dollars continue to shrink, the push for efficient use of resources increases the difficulty in providing OME in a modality that best promotes learning and retention. Use of multimedia, interactive education, and performance feedback have higher implementation costs, but lead to deeper participant learning and better meets the needs of the diverse workforce (Labeau, 2013; Militello et al., 2014; Phillips, 2005). Protected time for online education, improves participant satisfaction and commitment to learning content, leading to greater learning outcomes (Cottrell & Donaldson, 2013; Rankin et al., 2013; Smith et al., 2013). Decisions regarding level of desired cognitive achievement must guide both online modality choices and time provisions for learning. In addition, as described in the previous section, organizations need to demonstrate active commitment to change, initiated by high-quality education, through collaboration, planning, and resource support. While it is difficult to quantify return on educational investment, the trend towards pay-for-performance and incentives based on patient satisfaction create a financial motivation to provide educational interventions and support that promotes achievement of desired patient outcomes.

Conclusion

While it is imperative for professional nurses to maintain competency in practice and meet the requirements of regulatory and compliance agencies in the name of better patient care, this project has found that the current research lacks conclusive evidence regarding best practice interventions that lead to desired learning, practice, and patient outcomes. The heterogeneity of study design and inconsistent findings regarding effective OME reduced the ability to generalize. However, a few key points were gleaned from the research. OME with adaptability to multiple learning styles better personalizes the experience to the adult learner (Labeau, 2013; Phillips,

2005). Learning modules with high interactivity and feedback mechanisms promote active versus passive learning and elicit deeper understanding (Labeau, 2013; Militello et al., 2014; Phillips, 2005). Objective evaluations of knowledge gains provide a better indication of actual learning for outcome measurement (Lahti et al., 2014). Finally, education will not succeed in accomplishing practice change and achieving better patient outcomes without identifying and mitigating the barriers to change and obtaining positive support from administration (Schroeder et al., 2016; Virani et al., 2009).

Since the turn of the millennia, the nursing profession has been witness to a significant shift in the delivery of training and education to satisfy mandatory education requirements. The rapid transition to online delivery of mandatory education has streamlined distribution of new knowledge, reduced costs, and decreased the time needed to provide RN staff with the essential information to maintain practice competency and regulatory compliance (Labeau, 2013).

Unfortunately, as in any educational modality, the learning environment and quality of delivery greatly affects cognitive gains. The literature reviewed for this project presented an incomplete picture in determining the most effective elements needed in successful transition of knowledge and skills from computer screen to care areas. Future research is needed to determine what specific interventions best meet the needs of the diverse learner audience, achieve participant satisfaction, and result in knowledge retention and application while still maintaining responsible use of resources. Future research also needs to examine the factors that affect the successful transition of OME to nursing practice and lead to better patient outcomes.

While technology will continue to evolve and provide the NPD specialist a wider range of options for online delivery of education, maintaining adherence to the needs of the adult

learner and considerations towards the specific learning needs and preferences of the audience must always be the guiding principles driving creation of effective online mandatory education.

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Appendix A

Description of Studies Included in Literature Review

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|--|--|---|---|--|---|--|
| <p>Cottrell, S., & Donaldson, J. H. (2013).</p> <p>Exploring the opinions of registered nurses working in a clinical transfusion environment on the contribution of e-learning to personal learning and clinical practice: Results of a small scale educational research study.</p> <p><i>Nurse Education in Practice, 13</i>, 221-227.</p> <p>Level of Evidence (Using AACN): Level C Phenomenological study</p> | <p>Primary objectives: Determine if e-learning accommodates learning styles.</p> <p>Secondary objectives: Evaluate if online learning affect individual practice change.</p> <p>Tertiary Objective: Determine RN perception of future transfusion learning needs.</p> | Phenomenological study of RN opinions of standardized online blood transfusion training | <p>Inclusions: RNs who had completed <i>learnbloodtransfusion.com</i> online learning modules in last three months.</p> <p>Exclusions: RNs who had not completed online training.</p> <p>Sample size: 89 participant invitations. (n=7) interview participants</p> | <p>Database search: Completed, but search methods not described.</p> <p>Quantitative Methods: None</p> <p>Qualitative Methods: Evaluation of semi-structured interviews using thematic analysis</p> | <p>RN participants recognized own personal learning style.</p> <p>RNs preferred that education was relevant to practice and met learning needs.</p> <p>Multimodal approaches that utilize visual, auditory, and kinesthetic attributes enhanced learning.</p> | <p>Strengths: Phenomenological approach examined RN's individual responses versus Likert scale only.</p> <p>Limitations: Low participant response and small sample size decreases generalizability of findings.</p> <p>Qualitative methods only.</p> <p>Bias risk due to researchers compiling data from interviews.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|--|---|---------------------------|---|---|--|---|
| <p>Du, S., Liu, Z., Liu, S., Yin, H., Xu, G., Zhang, H., & Wang, A. (2013).</p> <p>Web-based distance learning for nurse education: a systematic review.</p> <p><i>International Nursing Review</i>, 60(2), 167-177.</p> <p>Level of Evidence (Using AACN): Level C Systematic Review</p> | <p>Primary objectives: Evaluate the efficacy of e-learning for nursing students and RNs.</p> <p>Secondary objectives: Evaluate learner satisfaction with online learning.</p> | Systematic Review of RCTs | <p>Inclusions: Studies published between 2006 and 2012 comparing online learning to control of traditional learning or no learning.</p> <p>Exclusions: Studies with no control. Non-RCTs</p> <p>Sample size: None RCTs</p> | <p>Database search: PubMed and Embase</p> <p>Evaluation Methods: Narrative description of studies due to variety in study design and results reporting.</p> | <p>Online learning has equivalent or greater effects on knowledge acquisition.</p> <p>Most learners are satisfied with online education.</p> <p>More rigorous studies are needed to evaluate efficacy of online education.</p> | <p>Strengths: Two independent reviewers selected studies to reduce bias.</p> <p>Critical appraisal of RCTs using peer reviewed format.</p> <p>Limitations: No meta-analysis of findings due to differences in study design.</p> <p>Limited number of RCTs included and differences in reporting limit generalizability of findings.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|--|---|--|---|--|--|---|
| <p>Evatt, M., Ren, D., Tuite, P., Reynolds, C., & Hravnak, M. (2014).</p> <p>Development and implementation of an educational support process for electronic nursing admission assessment documentation.</p> <p><i>MEDSURG Nursing</i>, 23(2), 89-100.</p> <p>Level of Evidence (Using AACN): Level B RCT with consistent results</p> | <p>Primary objectives: Improve timeliness and accuracy of EMR assessment documentation through e-learning and support intervention over traditional eLearning.</p> <p>Secondary objectives: Improvement in RN attitude and knowledge regarding admission documentation requirements in EMR.</p> | <p>Single group pre and post evaluation with historical control.</p> <p>Intervention of online presentation augmented by face-to-face instruction.</p> <p>Comparison to eLearning only historical performance.</p> | <p>Inclusions: RNs working in a medical ICU or Trauma/burn ICU in PA.</p> <p>Exclusions: Other units.</p> <p>Sample size: 99 RN's</p> <p>Review documentation of 200 randomly selected charts (n=100) pre and (n=100) post intervention.</p> | <p>Database search: CINAHL, PubMed, OVID, and Cochrane Library Medline</p> <p>Quantitative Measurement: RNs completed knowledge and attitude survey using Likert scale pre and post intervention.</p> <p>EMR chart documentation audits.</p> | <p>Statistically significant improvement in 14 of 16 areas on admission documentation form ($p < 1.001$). Documentation completion improved from 84 to 93% after intervention.</p> <p>Statistically significant improvement ($p < 0.001$) in RN self-reported knowledge and attitudes about admission documentation.</p> | <p>Strengths: Objective evaluation of documentation completion using EMR assessment tools.</p> <p>Easily reproduced study.</p> <p>Limitations: No evaluation of quality of assessment documentation, only completion.</p> <p>Intervention limited to two ICU units limits generalizability.</p> <p>Pre and posttest given immediately after intervention. No determination in change over time.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem / Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|--|--|---|--|---|---|--|
| <p>Kontio, R., Hätönen, H., Joffe, G., Pitkänen, A., Lahti, M., & Välimäki, M. (2013).</p> <p>Impact of eLearning course on nurses' professional competence in seclusion and restraint practices: 9-month follow-up results of a randomized controlled study.</p> <p><i>Journal of Psychiatric and Mental Health Nursing</i>, 20, 411-418.</p> <p>Level of Evidence (Using AACN): Level B RCT with consistent results</p> | <p>Primary objectives: Evaluate growth in long-term competence and knowledge post online educational intervention versus control.</p> <p>Secondary objectives: Assess change in nurse's attitudes towards restraint and seclusion.</p> | <p>Retrospective study of RCT with control.</p> <p>Evaluated long-term competence changes between 120-hour eLearning modality to five day training-as-usual in restraint and seclusion.</p> | <p>Inclusions: RNs included in 2011 study</p> <p>Exclusions: RNs not involved in initial study.</p> <p>Sample size: 195 initial, 137 completed study. (n=87) intervention, (n=59) in control group.</p> | <p>Database search: None specified.</p> <p>Quantitative Measurement: RN self-report using Likert style questionnaire evaluating knowledge and self-efficacy on restraint and seclusion practices.</p> <p>Comparisons of three month and nine month changes between and within groups.</p> | <p>No growth in competence between online and traditional modalities.</p> <p>No change in attitudes among intervention group.</p> <p>Recommended online program be modified or used as adjunct to traditional methods to augment understanding and promote continued growth</p> | <p>Strengths: Results by demographic.</p> <p>Relatively large sample size evaluated.</p> <p>Simple, reproducible methods</p> <p>Qualitative results</p> <p>Limitations: High attrition rate between studies potentially biases results.</p> <p>No objective cognitive gains test to augment RN self-report.</p> <p>No use of qualitative measurements to determine reasons for lack of growth in staff knowledge or attitudes regarding restraint and seclusion.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|---|--|--|---|--|---|---|
| <p>Kontio, R., Pitkänen, A., Joffe, G., Katajisto, J., & Välimäki, M. (2014).</p> <p>eLearning course may shorten the duration of mechanical restraint among psychiatric inpatients: A cluster-randomized trial.</p> <p><i>Nordic Journal of Psychiatry</i>, 68, 443-449.</p> <p>Level of Evidence (Using AACN): Level B RCT with consistent results</p> | <p>Primary objectives: Explore impact of eLearning course on restraint and seclusion practices among psychiatric patients.</p> <p>Secondary objectives: None</p> | <p>Secondary analysis of previous RCT study.</p> <p>Cluster-randomized trial comparing 120-hour eLearning to five day training-as-usual.</p> | <p>Inclusions: RNs in acute, closed, adult inpatient wards.</p> <p>Exclusions: Adolescent, rehab, or geriatric wards or units with other coercion research running concurrently.</p> <p>Sample size: Four units (two control, two intervention).</p> | <p>Database search: Cochrane systematic review.</p> <p>Qualitative Measurement: None</p> <p>Quantitative Measurement: Chart review.</p> <p>Rate and duration of restraint and seclusion on wards over 24 months following educational intervention.</p> | <p>No statistically significant changes in rates of seclusion or restraint.</p> <p>Average duration of restraint time decreased from 36 to 4 hours ($p < 0.001$).</p> | <p>Strengths: Qualitative data only. Easily reproduced</p> <p>Limitations: Secondary analysis using historical data. Limited description of first study. Hard to determine number of RN participants in training and still working on units. High participant loss since the intervention in 2011 decreases usefulness of results.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|---|--|--|--|--|--|--|
| <p>Labeau, S. O. (2013).</p> <p>Is there a place for e-learning in infection prevention?</p> <p>Australian Critical Care, 26(4), 167- 172.</p> <p>Level of Evidence (Using AACN):</p> <p>Level C Literature Review</p> | <p>Primary objectives: Evaluate the efficacy of e-learning in infection prevention</p> <p>Secondary objectives: None specified</p> | <p>Non- comprehensive review of literature</p> | <p>Inclusions: Based on keywords dealing with online learning, healthcare education, infection control, and critical care. based on publish date.</p> <p>Exclusions: No exclusion Articles not printed in English, French, German, or Dutch.</p> <p>Sample size: Not specified.</p> | <p>Database search: PubMed, CINAHL, Web of Science</p> <p>Areas of evaluation:</p> <p>Advantages and Disadvantages of e- learning</p> <p>E-learning for healthcare professionals.</p> <p>E-learning for critical care continuing education.</p> <p>E-learning for infection control.</p> | <p>Few online courses for infection control.</p> <p>Trends in learner satisfaction and effectiveness indicate online learning may be effective for healthcare continuing education.</p> <p>More research into cost effectiveness of modality is needed.</p> <p>Current e-learning should utilize most recent technologies to maximize interactivity.</p> | <p>Strengths: Few exclusion criteria</p> <p>Use of peer-reviewed work only</p> <p>Limitations: Non-specific to number of studies included in review.</p> <p>No exclusions based on published date, inclusion of old literature.</p> <p>Heterogeneity of study methodologies and measurement criteria limits generalizability of results.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|---|---|-----------------------|--|--|--|---|
| <p>Lahti, M., Hätönen, H., & Välimäki, M. (2014).</p> <p>Impact of e-learning on nurses' and student nurses knowledge, skills, and satisfaction: A systematic review and meta-analysis.</p> <p><i>International Journal of Nursing Studies</i>, 51(1), 136-149.</p> <p>Level of Evidence (Using AACN): Level A Meta-analysis</p> | <p>Primary objectives: Review effect of online learning of RNs' and student nurses' knowledge and skill acquisition.</p> <p>Secondary objectives: Evaluate learner satisfaction with online learning.</p> | Meta-analysis of RCTs | <p>Inclusions: RCTs published between 2004 and 2010 evaluating e-learning versus traditional learning.</p> <p>Exclusions: Studies without comparison groups</p> <p>Sample size: 11 RCTs of 2491 participants.</p> | <p>Database search: MEDLINE, CINAHL, Psychinfo, and ERIC.</p> <p>Evaluation Methods: Statistical analysis of RCT findings.</p> | <p>Wide variety of interventions used in study designs.</p> <p>Few studies evaluate e-learning and knowledge gains.</p> <p>No statistical difference between e-learning and traditional in regards to knowledge or skill acquisition.</p> <p>No difference in satisfaction scores between learning modalities.</p> | <p>Strengths: Statistical analysis of RCTs for meta-analysis.</p> <p>Evaluated RCTs with controls only</p> <p>Limitations: No independent review of trials to determine inclusions/exclusions.</p> <p>High heterogeneity of trial designs limits conclusions.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|---|---|---|---|---|---|---|
| <p>Lam-Antoniades, M., Ratnapalan, S., & Tait, G. (2009).</p> <p>Electronic continuing education in the health professions: An update on evidence from RCTs.</p> <p><i>Journal of Continuing Education in the Health Professions</i>, 29(1), 44-51.</p> <p>Level of Evidence (Using AACN): Level C Literature Review</p> | <p>Primary objectives: Assess effectiveness of online continuing education (CE) for health professionals</p> <p>Secondary objectives:</p> | <p>Literature Review of RCTs evaluating online CE</p> | <p>Inclusions: Studies 2004 to 2007. RCTs Evaluating online CE for all healthcare providers.</p> <p>Exclusions: CE for students</p> <p>Sample size: 15 studies</p> | <p>Database search: MEDLINE, EMBASE, CINAHL</p> <p>Areas of evaluation: Influence of multimedia in knowledge and retention gains.</p> <p>Identification of what types of multimedia are most effective.</p> | <p>Flat text has limited affect in improving knowledge.</p> <p>Interactive multimedia similar in effectiveness to lecture.</p> <p>Knowledge retention up to five months seen in one study.</p> <p>No study identified which components of interactive online education had the most effect</p> <p>No studies evaluated patient outcomes due to educational intervention</p> | <p>Strengths: Explicit inclusion criteria</p> <p>Larger study size compared to other reviews in this project.</p> <p>Limitations: Limited explanation of study methodologies and results in determining conclusion</p> <p>Limited review of results of included studies</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|--|--|---|--|---|---|---|
| <p>Liu, W-I., Rong, J-R, & Liu, C-Y. (2014).</p> <p>Using evidence-integrated e-learning to enhance case management continuing education for psychiatric nurses: A randomized controlled trial with follow-up.</p> <p>Level of Evidence (Using AACN): Level B RCT with consistent results</p> | <p>Primary objectives: Evaluate the effectiveness of an e-learning program in case management.</p> <p>Secondary objectives: Assess retention of knowledge three months after intervention.</p> | <p>Random allocation of psychiatric registered nurses.</p> <p>Previous pilot study completed to assess program quality.</p> | <p>Inclusions: Psychiatric nurses that were members of Psychiatric Mental Health Nurses Association in Taiwan.</p> <p>Exclusions: RNs not working in psychiatric nursing.</p> <p>Sample size: 216 (108 experimental, 108 control)</p> | <p>Database search: Not specified for review of literature</p> <p>Intervention (n= 108): Five 20-minute learning modules with virtual lecture materials. Self-assessment quiz at end of modules. Video examples of simulated case management scenarios.</p> <p>Control (n=108): No learning intervention</p> <p>Evaluation Methods: Pre-test, one, and three month follow-up exams.</p> <p>Participant satisfaction via Likert Scale.</p> | <p>Statistically significant increase in knowledge scores compared to control group</p> <p>Majority of Likert scores indicated interventions group agreed or strongly agreed that the program was flexible, inspired learning, was enjoyable, and promoted autonomous learning.</p> | <p>Strengths: RCT</p> <p>Large sample size</p> <p>Easily reproduced design</p> <p>Objective evaluation tools</p> <p>Results reported by demographic</p> <p>Tested with pilot study</p> <p>Limitations: Comparing results of intervention to control group with no intervention.</p> <p>No objective evaluation of skill improvement</p> <p>Participants and researchers not blinded to intervention.</p> <p>No evaluation of long-term effect of intervention on case management abilities of patient outcomes.</p> <p>Possible participation bias due to voluntary participation and lack of blinding.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|---|---|--|--|--|---|---|
| <p>Maloney, S., Haas, R., Keating, J. L., Molloy, E., Sims, J., Morgan, P., & Haines, T. (2011).</p> <p>Effectiveness of web-based versus face-to-face delivery of education in prescription of falls-prevention exercise to health professionals: Randomized trial.</p> <p><i>Journal of Medical Internet Research</i>, 13(4), e116.</p> <p>Level of Evidence (Using AACN): Level B RCT with consistent results</p> | <p>Primary objectives: Compare effectiveness of online versus single day face-to-face training in training falls prevention to HCP.</p> <p>Secondary objectives: Evaluate learner satisfaction between the two modalities. Evaluate change in practice among HCP post intervention.</p> | <p>RCT</p> <p>Single day traditional course versus 4-week instructor guided online course with interactive and self-test elements.</p> | <p>Inclusions: RNs and non-physician HCP at multiple sites in Australia.</p> <p>Exclusions: Physicians and non-HCP.</p> <p>Sample size: 166 initial. 94 completed. (n=44) Web-based, (n=50) face-to-face.</p> | <p>Database search: Review of falls prevention literature – source unspecified.</p> <p>Quantitative Measurements: Cognitive gains test one week after intervention. Evaluation of exercise program developments. Pearson coefficient comparison.</p> <p>Qualitative Measurement: Likert scale self-report of change in practice one week after intervention</p> | <p>No difference in learner satisfaction between modalities ($p < 0.005$).</p> <p>No difference in practice change between groups ($p = 0.07$)</p> <p>No difference in cognitive test scores ($p = 0.07$)</p> | <p>Strengths: Blinded evaluation of participant performance.</p> <p>Easily reproduced study</p> <p>Moderate correlation between cognitive and psychomotor performance</p> <p>Limitations: No long-term follow-up to evaluation retention of adherence to practice change.</p> <p>No comparison to control of no intervention to evaluate educational or practice gains.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|--|---|---|--|--|--|---|
| <p>Mc Crow, J., Sullivan, K. A., & Beattie, E. R. (2014).</p> <p>Delirium knowledge and recognition: A randomized controlled trial of a web-based educational intervention for acute care nurses.</p> <p><i>Nurse Education Today</i>, 34(6), 912-917.</p> <p>Level of Evidence (Using AACN): Level B RCT with consistent results</p> | <p>Primary objectives: Improve and maintain delirium knowledge and recognition performance in acute care RN's.</p> <p>Secondary objectives: Evaluate delirium recognition and knowledge gains over time post intervention.</p> <p>Tertiary Objective: Assess learner satisfaction with online learning format.</p> | <p>RCT using pre-/posttest design.</p> <p>Compare web-based education versus control of no education. Testing occurred pre- (T1), immediately post (T2), and six to eight weeks post (T3) intervention.</p> | <p>Inclusions: RNs working in acute care at three hospitals in Australia.</p> <p>Exclusions: Casual RNs and RN staff that scored low on Online Readiness exam.</p> <p>Sample size: 175 (147 completed), (n=72) control group, (n=75) intervention</p> | <p>Database search: None specified</p> <p>Quantitative Measurement: Performance on five case scenario vignettes.</p> <p>RN evaluation of online course via Likert scale.</p> | <p>Significant increase in DK and DR scores in intervention group versus control (p<0.001) at T2.</p> <p>No gain in DK and minor loss in DR at T3 assessment.</p> <p>High learner satisfaction (84%) with format and delivery of online modality.</p> | <p>Strengths: Relative large study using expert-reviewed standardized assessment of cognitive performance.</p> <p>Evaluation of knowledge gains at three points in time.</p> <p>Limitations: Exclusion of RN's with low computer literacy skills biases results and reduces overall assessment of effectiveness of online modality.</p> <p>Comparison of intervention to no intervention decreases use of data in determining effectiveness of online modality.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|---|--|---|--|---|--|--|
| <p>Mollon, D., Fields, W., Gallo, A-M., Wagener, R., Soucy, J., Gustafson, B., & Chae Kim, S. (2012).</p> <p>Staff practice, attitudes, and knowledge/skills regarding evidence-based practice before and after an educational intervention.</p> <p><i>The Journal of Continuing Education in Nursing</i>, 43(9), 411-419.</p> <p>Level of Evidence (Using AACN): Level C</p> <p>Descriptive Study</p> | <p>Primary objectives: Assess professional clinical staff's baseline and post education knowledge and skill regarding use of evidence-based practice.</p> <p>Secondary objectives: Evaluate changes in knowledge and skill after an online intervention.</p> | <p>Descriptive study using pre and post survey design.</p> <p>Evaluated clinical staff's change in practice, knowledge, and attitude before and after an online learning intervention on EBP.</p> | <p>Inclusions: Professional clinical staff responsible for patient care</p> <p>Exclusions: Practitioners without direct care role. Non-direct care staff.</p> <p>Sample size: (n=327) 24% of 1,381 eligible staff completed survey.</p> | <p>Database search: Completed, search strategy not specified</p> <p>Qualitative Measurement: None</p> <p>Quantitative Measurement: Staff surveys completed using Clinical Effectiveness and Evidence-based Practice Questionnaire with Likert scaling.</p> | <p>No statistically significant changes in use of information resources after online education</p> <p>Online education did not change knowledge or skills in using EBP.</p> <p>Online modules may not be the most effective method for teaching EBP.</p> <p>Educational degree had a high correlation with knowledge, attitudes, and skills toward using EBP</p> | <p>Strengths: Used peer-reviewed evaluation instrument.</p> <p>Results reported by demographic</p> <p>Limitations: No objective evaluation of knowledge gains</p> <p>Identical pre and post surveys confused participants and reduced response rate</p> <p>Sampling of one hospital limited generalizability</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|---|--|--|--|---|--|--|
| <p>O'Leary, F. (2012).</p> <p>Paediatric resuscitation training: Is e-learning the answer? A before and after pilot study.</p> <p><i>Journal Of Paediatrics & Child Health</i>, 48(6), 529-533.</p> <p>Level of Evidence (Using AACN): Level C Prospective Study with no control</p> | <p>Primary objectives: Evaluate whether an e-learning program can improve knowledge and competence of ED staff in pediatric resuscitation.</p> <p>Secondary objectives: Obtain feedback from participants on perceptions</p> | <p>Prospective before and after design with no control.</p> <p>E-learning consisted of CD training in BLS and ALS</p> <p>Pre- and post-intervention cognitive and psychomotor skills assessment.</p> <p>Pre and post intervention participant self-efficacy rating using Likert scale questionnaire.</p> | <p>Inclusions: RNs and MDs working in one pediatric ED.</p> <p>Exclusions: RNs and MDs outside of single ED.</p> <p>Sample size: 56. (29 MDs and 27 RNs).</p> | <p>Database search: None reported</p> <p>Quantitative Methods: Cognitive and Psychomotor skill assessment of ALS and BLS.</p> <p>Participant self-efficacy assessment using Likert Scale questionnaire.</p> | <p>Statistically significant improvement in ALS and BLS performance ($p=0.001$).</p> <p>Greatest improvements in rhythm recognition and time to defibrillation.</p> <p>Statistically significant ($p<0.001$) improvement in self-reported knowledge and confidence.</p> <p>E-learning can augment traditional education and help maintain clinician skills.</p> | <p>Strengths: Easily reproduced study Reasonably large sample size.</p> <p>Limitations: Low generalizability due to single setting.</p> <p>BLS and ALS evaluator not blinded to study participants.</p> <p>Did not use peer reviewed educational materials.</p> <p>93% of participants had completed standard ALS or BLS training in last three years creating learning evaluation bias.</p> <p>High retest rate among participants confounds results.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|---|--|---------------------------------|---|---|--|--|
| <p>Petty, J. (2014). Exploring the effectiveness of an interactive, technology-enabled learning tool to enhance knowledge for neonatal nurses.</p> <p><i>Neonatal, Paediatric & Child Health Nursing, 17(1), 2-10.</i></p> <p>Level of Evidence (Using AACN): Level B RCT with consistent results</p> | <p>Primary objectives: Explore differences in interactive versus non-interactive online neonatal biology training in regards to cognitive gains.</p> <p>Secondary objectives: Evaluate learner satisfaction differences between interactive and non-interactive versions</p> | <p>RCT using mixed methods.</p> | <p>Inclusions: RNs without neonatal certification and with less than 18 months experience in the specialty.</p> <p>Exclusions: Fully certified RNs and those with more than 18 months experience.</p> <p>Sample size: 31 novice neonatal nurses (n=16) in interactive group, (n=15) non-interactive group.</p> | <p>Database search: None specified</p> <p>Qualitative methods: Pre- and post-test on neonatal biology.</p> <p>RN satisfaction survey (using Likert scale) regarding learning preferences (interactive to non-interactive)</p> <p>Quantitative measurements: Learner description of experience with the different learning modes.</p> | <p>Significant increases in knowledge scores for both groups. No difference in mean increases in knowledge scores.</p> <p>Significantly higher satisfaction scores in interactive versus non-interactive groups.</p> | <p>Strengths: Used peer-reviewed and validated knowledge test and satisfaction questionnaire.</p> <p>Limitations: No comparison between participant responses and learning styles.</p> <p>Small sample groups limit generalizability.</p> <p>Measured retention in the immediate post-intervention period. No evaluation of long-term retention.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|--|--|---|---|--|--|--|
| <p>Pilcher, J. W., & Bedford, L. (2011).</p> <p>Willingness and preferences of nurses related to learning with technology.</p> <p><i>Journal for Nurses in Staff Development</i>, 227(3), E10-E16.</p> <p>Level of Evidence (Using AACN): Level C Descriptive Study</p> | <p>Primary objectives: Determine what type of ongoing education is preferred to be undertaken online.</p> <p>Secondary objectives: Determine learning preferences based on delivery mode</p> <p>Tertiary objective: Determine demographic factors on nurses willingness to use technology</p> | <p>Descriptive study using mixed method. Combination of semi-structured interview for (n=9) group and survey questionnaire.</p> | <p>Inclusions: RNs working in six specialty units</p> <p>Exclusions: RNs from Veteran generation.</p> <p>Sample size: Nine volunteers interviewed from 387 employed nurses.</p> <p>190 survey responses.</p> | <p>Database search: No explanation of databases used in search</p> <p>Quantitative Measurement: Likert scale survey of RN willingness to use technology and learning preferences. Results delineated by generational age.</p> <p>Qualitative Measurement: Interview of the lived experience of nine RNs in regards to online leaning.</p> | <p>91.6% of nurses in all groups were more willing to use lecture or classroom interaction versus online.</p> <p>61.6% preferred lecture to online.</p> <p>64.2% preferred classroom versus individual learning.</p> <p>64.7% preferred online education for mandatory or on the job requirements.</p> <p>54.9% of RN's were kinesthetic learners, 24.3% visual learners.</p> <p>Nurses in all generations preferred hard copy to e-copy of materials.</p> <p>Preference for online training depends on topic.</p> | <p>Strengths: Results listed by demographic (age, degree, and experience). Relatively large survey with 50% response rate.</p> <p>Easily reproduced study.</p> <p>Limitations: Low sample size of interview participants limits generalizability of qualitative portion.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|--|--|---|---|--|---|---|
| <p>Rankin, J. A., Then, K. L., & Atack, L. (2013).</p> <p>Can emergency nurses' triage skills be improved by online learning? Results of an experiment.</p> <p><i>Journal of Emergency Nursing</i>, 39(1), 20-26.</p> <p>Level of Evidence (Using AACN): Level B RCT with consistent results</p> | <p>Primary objectives: Determine if online discussion and post learning group project enhances learning over traditional web-based learning.</p> <p>Secondary objectives: Determine if tutorials to improve RN computer skills enhance learning.</p> | <p>Random allocation of registered nurses to intervention or control group.</p> <p>Evaluation via blinded chart audit of triage system use, staff interviews, and Likert scale questionnaire.</p> | <p>Inclusions: Emergency room nurses in Canada.</p> <p>Exclusions: Nurses working in other departments</p> <p>Sample size: 132 (65 experimental, 67 control)</p> | <p>Database search: CINAHL and MEDLINE.</p> <p>Intervention (n=65): mandatory tutorial, online discussion, and group learning project.</p> <p>Control (n=67): optional tutorial and discussion. No group learning project.</p> <p>Quantitative measurement: Chart review for triage accuracy by blinded Canadian Triage Acuity Scale expert. Message count on discussion board.</p> <p>Qualitative measurement: Two standardized staff satisfaction questionnaires.</p> | <p>No statistically significant difference in triage accuracy between groups after completion of learning.</p> <p>No significant difference in learner satisfaction between groups.</p> <p>Adding mandatory discussion and workplace project did not improve staff satisfaction.</p> <p>No demographic difference in results.</p> | <p>Strengths: RCT</p> <p>Multicenter</p> <p>Easily reproduced study design</p> <p>Used well accepted evaluation tools</p> <p>Results by demographic</p> <p>Evaluated participant and patient outcomes</p> <p>Limitations: No posttest to quantitatively evaluate cognitive outcomes</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|---|--|---|--|---|--|--|
| <p>Schroeder, D. L., Hoffman, L. A., Fioravanti, M., Poskus Medley, D., Zullo, T. G., & Tuite, P. K. (2016).</p> <p>Enhancing Nurses' Pain Assessment to Improve Patient Satisfaction.</p> <p><i>Orthopaedic Nursing</i>, 35(2), 108-119.</p> <p>Level of Evidence (Using AACN): Level C Study without control</p> | <p>Primary objectives: Improve patient pain management and satisfaction through RN online education program.</p> <p>Secondary objectives: Develop an effective online education tool</p> | <p>Pre/post intervention design with single group.</p> <p>Online RN education.</p> <p>Pain assessment and intervention reminder posters and cards on unit</p> | <p>Inclusions: RNs on single orthopedic unit.</p> <p>Exclusions: None for single unit.</p> <p>Sample size: 28 RNs on one orthopedic unit.</p> <p>190 surveys of post-op orthopedic patients in three months following intervention. 151 completed returns</p> | <p>Database search: None specified.</p> <p>Qualitative Methods: RN focus group. Five question interview evaluating perceptions of changes in pain assessment on unit.</p> <p>Quantitative Methods: RN knowledge assessment pre and post intervention.</p> <p>Patient outcomes – American Pain Society Questionnaire and HCAHPS scores 3 months after intervention.</p> | <p>5% relative improvement in HCAHPS scores (patient satisfaction).</p> <p>No change in patient reported pain level.</p> <p>RN unaware of patient satisfaction and Medicare reimbursement.</p> | <p>Strengths:</p> <p>Easily reproduced study.</p> <p>Used well accepted evaluation tools</p> <p>Limitations: Lack of cognitive measurement of nurse knowledge gains. Limited to self-report only.</p> <p>Single unit format limits generalizability of results.</p> <p>Added unit reminders to augment intervention which confounds results.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|--|---|--|--|---|---|---|
| <p>Sherman, H., Comer, L., Putnam, L., & Freeman, H. (2012). Blended versus online learning: Outcomes for staff development. <i>Journal for Nurses in Staff Development</i>, 28(4), 186-190. Level of Evidence (Using AACN): Level B RCT with consistent results</p> | <p>Primary objectives: Identify differences in learning outcomes or learner satisfaction in traditional lecture versus predominantly online format.</p> <p>Secondary objectives: Identify any relationship between demographics and above outcomes.</p> | <p>Blinded, randomized controlled trial.</p> <p>Test grading completed by trained RN educator using rubric.</p> <p>Focus group used to determine staff satisfaction.</p> | <p>Inclusions: Newly hired or transferred registered nurses orienting to critical care (CC) with limited prior CC experience.</p> <p>Exclusions: Experienced CC nurses.</p> <p>Sample size: 68 (35 in experiment, 33 in control).</p> | <p>Randomized through random drawing.</p> <p>Intervention: (n=35) 4.5 hrs of online modules with 2-hour discussion session after completion.</p> <p>Control: (n=33) 6.5 traditional lecture</p> <p>Quantitative Measurement: 46- item blinded and proctored posttest. Results compared against demographics of groups.</p> <p>Qualitative Measurement: Voluntary focus group discussion regarding satisfaction with learning. Evaluation with Likert scale.</p> | <p>No statistically significant difference in cognitive outcomes between Intervention and control groups.</p> <p>No demographic differences in test scores between groups. Compared age, educational preparation, and years of nursing experience.</p> <p>Online/discussion group identified self-pacing and flexibility as highest satisfiers.</p> <p>Lecture group identified ability to interact with instructor as highest satisfier.</p> | <p>Strengths: Blinded, randomized controlled trial.</p> <p>Easily reproduced Homogenous sample population Quantitative evaluators.</p> <p>Limitations: No follow-up to determine long-term retention of material.</p> <p>Small relative sample size limits generalizability of results</p> <p>Limited discussion of studies used in creating RCT.</p> |

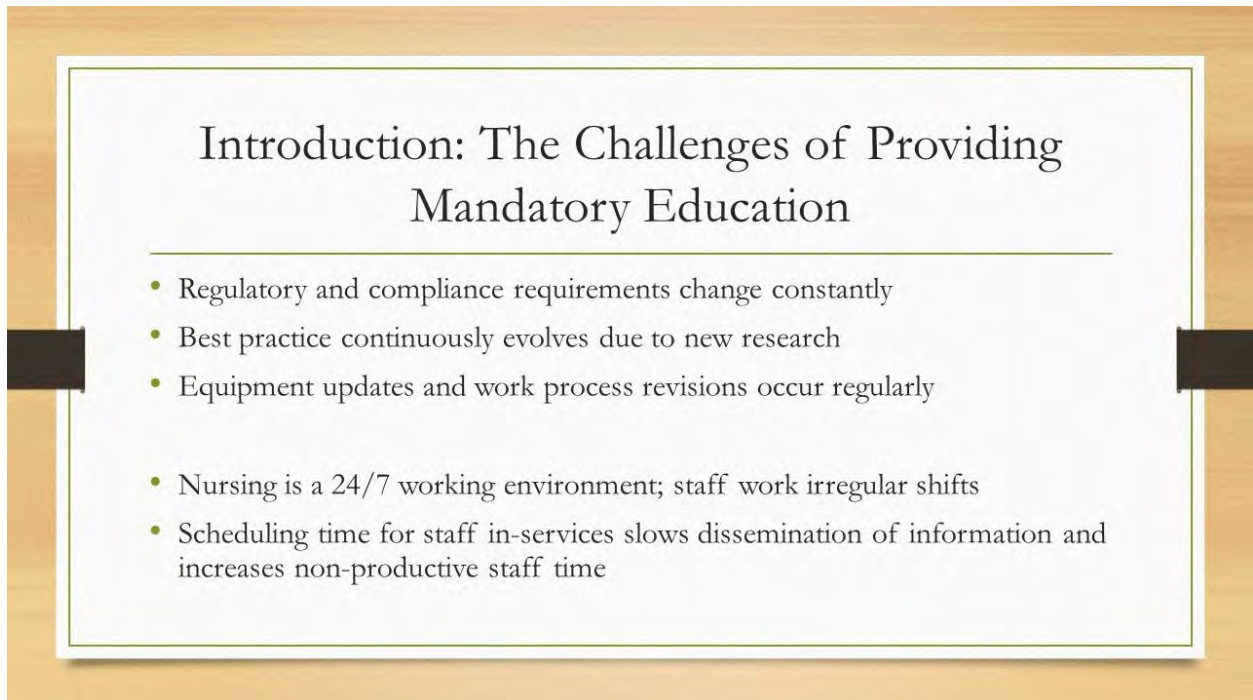
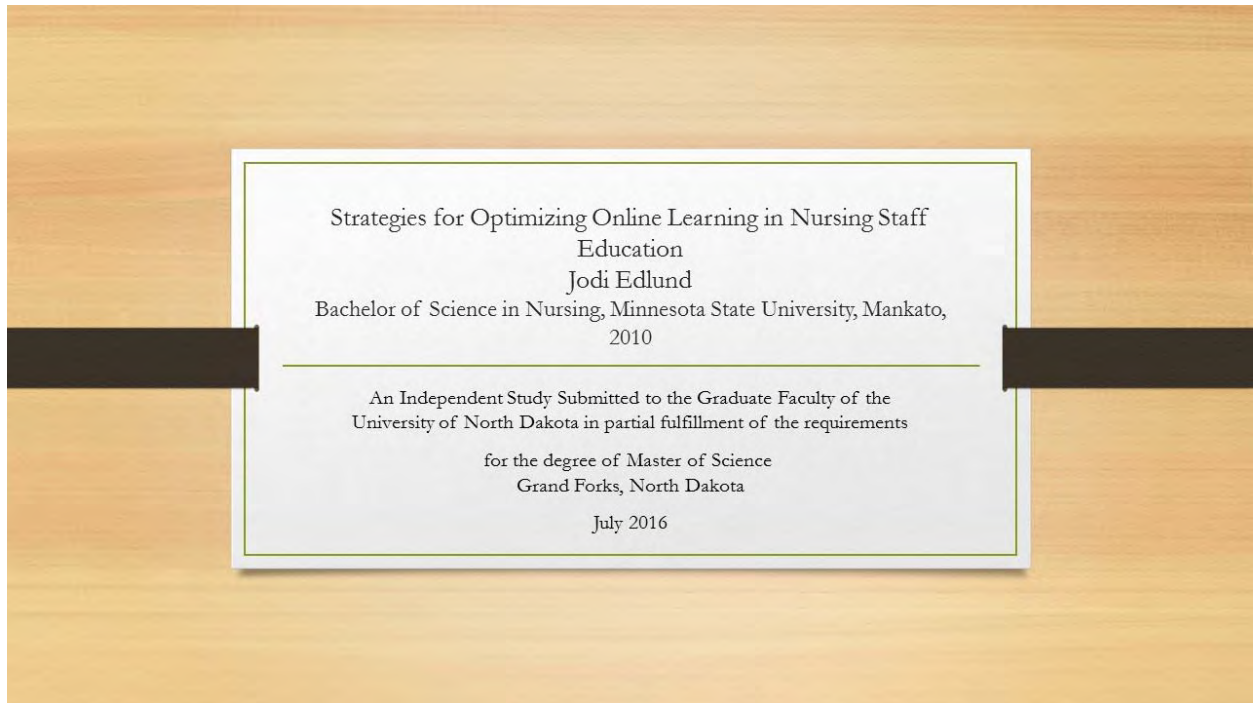
| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|---|---|---|--|--|---|---|
| <p>Sinclair, P. M., Kable, A., Levett-Jones, T., & Booth, D. (2016).</p> <p>The effectiveness of internet-based e-learning on clinician behavior and patient outcomes: A systematic review.</p> <p><i>International Journal of Nursing Studies</i>, 57, 70-81.</p> <p>Level of Evidence (Using AACN):</p> <p>Level C Systematic Review</p> | <p>Primary objectives: To evaluate current evidence regarding the effectiveness of e-learning on practice change.</p> <p>Secondary objectives: Evaluate effect of e-learning to promote change in patient outcomes.</p> | <p>Systematic Review with inconsistent findings. No meta-analysis due to wide differences in study methods and results reporting.</p> | <p>Inclusions: Studies published between 2004 and 2015 evaluating e-learning's effect on HCP practice and patient outcomes.</p> <p>Exclusions: Studies looking at HCP knowledge gains only. Descriptive studies evaluating learner experiences. Studies evaluating blended learning.</p> <p>Sample size: Review of seven trials</p> | <p>Database search: CINAHL, ERIC, Embase, MEDLINE, COCHRANE, Mosby's Index, and Scopus</p> <p>Evaluation Methods: Narrative review of study results. No statistical analysis due to wide differences in study design and evaluation methods.</p> | <p>E-learning at least equivocal to traditional learning in improving professional practice.</p> <p>Insufficient evidence regarding e-learning and improved patient outcomes.</p> | <p>Strengths: Study inclusions were determined by two independent researchers to limit bias.</p> <p>Large database search to capture studies.</p> <p>Limitations: Inconsistent study methodology and reporting limited data synthesis for evaluation.</p> <p>Evaluation limited to narrative review.</p> <p>Small trial list with inconsistent methodologies limited generalizations.</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|--|---|---|--|---|---|---|
| <p>Smeeckens, A.E.F.N., Broekhuijsen-van Henten, D. M., Sittig, J. S., Russel, M. B., TH J ten Cate, O., Turner, N. M. & van de Putte, E, M.</p> <p>(2011).</p> <p>Successful e-learning programme on the detection of child abuse in emergency departments: A randomized controlled trial. <i>Archives of Disease in Childhood</i>, 96, 330-334.</p> <p>Level of Evidence (Using AACN): Level B, RCT with consistent results</p> | <p>Primary objectives: Improve RN detection of child abuse in patients entering ED over control.</p> <p>Secondary objectives: Improve RN rates of self-efficacy in detection of child abuse over control.</p> | <p>RCT using pre and post design.</p> <p>Two-hour peer-reviewed e-learning program on child abuse recognition.</p> <p>Three-module program using simulation, animation, and interactive elements.</p> <p>Control – no intervention.</p> | <p>Inclusions: RNs in one ED unit in Netherlands</p> <p>Exclusions: All temporary RN staff in ED unit.</p> <p>Sample size: 38 initial 25 completed 12 control 13 intervention</p> | <p>Database search: None Specified</p> <p>Quantitative Measurement: Evaluation of RN pre and post intervention performance via simulation.</p> <p>RN self-evaluation of efficacy in detection of child abuse using visual analog scale.</p> | <p>RN improvement in history taking ($p=0.022$).</p> <p>No change in assessment of parent-child interactions.</p> <p>Improvement in RN self-efficacy score in post intervention group. ($p<0.05$).</p> | <p>Strengths: Simulation evaluation by experts blinded to participant allocation</p> <p>Easily reproduced study</p> <p>Three-person evaluation team for RN simulation evaluation.</p> <p>Limitations: Head researcher not blinded to study participants.</p> <p>36% attrition rate limits generalizability</p> <p>Single unit study limits generalizability</p> <p>No test of cognitive improvement post intervention, limited to RN self-report only</p> |

| Authors/ Publication Year, Title, Journal | Purpose/Problem/ Objective | Study Design | Sample Setting and Size | Data Collection/ Measurement Methods | Findings/ Analysis of Outcomes | Strengths/ Limitations |
|--|---|---|---|---|--|---|
| <p>Smith, M., Stolder, M. E., Jagers, B., Liu, M. F., & Haedtke, C. (2013). Depression training in nursing homes: Lessons learned from a pilot study. <i>Issues in Mental Health Nursing</i>, 34, 90-102.</p> <p>Level of Evidence (Using AACN): Level C, RCT with inconsistent results</p> | <p>Primary objectives: Evaluate nurse perceptions of a self-learning program or instructor-supported program on depressing in nursing home residents. Comparison to control of no intervention.</p> <p>Secondary objectives: Determine changes in depression free days among enrolled residents related to educational intervention</p> | <p>RCT with mixed methods. Two intervention groups.</p> <p>RN participants given self-assessment of knowledge and skill using Likert rating scale.</p> <p>Semi-structured RN interviews on usefulness of training.</p> <p>NH resident chart review for depression indicators.</p> | <p>Inclusions: RN and LPN volunteers in nursing homes with >50 beds.</p> <p>Exclusions: RNs and LPNs at nursing homes with <50 beds or specialty care nursing homes.</p> <p>Sample size: 58 (32 CD plus instructor support, 26 in CD only group). 59 Residents enrolled.</p> | <p>Database search: None specified</p> <p>Qualitative Measurement: Semi-Structured interviews with RN participants. Resident chart review of depression levels over 8 weeks.</p> <p>Quantitative Measurement: RN self-report Depression Training Program Evaluation</p> <p>Resident depression levels were only data collected in control group.</p> | <p>Decrease in depression levels in all three groups ($p<0.001$).</p> <p>Residents paired with nurses in either intervention group had more depression free days.</p> <p>No significant differences between tow control groups in perceptions of knowledge or skill gained.</p> <p>Improvement (5.1 to 5.5) in nurse perceived usefulness of training.</p> | <p>Strengths: Evaluated two interventions versus control. Easily reproduced. Used standardized resident assessment methods (Patient Health Questionnaire [PHQ-9]). Standardized Depression Training Program Evaluation for nurse outcome.</p> <p>Limitations: No comparison between intervention groups. Researchers completed resident chart reviews (not blinded to process). High attrition rate (59%) skews results</p> |

Appendix B

PowerPoint Lecture Slides



Is online mandatory learning (OME) the answer?

- Reaches a larger learner audience in a shorter timeframe
- Provides just-in-time education of vital changes
- Reduces non-productive labor costs
- Allows learners to receive education at time and place of their choosing
- Achieves greater staff satisfaction in many instances

(Altimier, 2009; Bindon, 2014; Elliott & Dillon, 2012; Scholl, 2007)

However...

- Many factors impact the effectiveness of OME in providing needed learning and retention
- Variations in content delivery and level of learner engagement impact effectiveness
 - Well-designed online modules, with significant learner interaction, have shown to be equivalent to traditional instruction in promoting behavioral changes in learners
 - Poorly-designed learning modules fail in imparting any real learning or behavioral change

(Bindon 2014; Berger, Topp, Davis, Jones, & Stewart, 2009; Mollon et al., 2012; Muir, 2001; Rankin, Then, & Attack, 2013)

Other points to consider...

OME alone won't
achieve or maintain
meaningful practice
change

(Schroeder et al., 2016; Virani, Lemieux-Charles, & Berta, 2009)

OME alone won't
achieve
organizational
outcomes

(AHRQ, 2014b; Virani et al. 2009)

How do we achieve better learning outcomes with OME?

- We need to determine what elements in OME will:
 - Provide learner satisfaction
 - Promote learning retention
 - Promote practice change
 - Achieve desired target patient outcomes
- Key elements in successful OME included in analysis:
 - Generational differences
 - Learning preferences
 - Level of engagement
 - Topic suitability

Theoretical Framework: Adult Learning Theory (ALT)

Support for ALT

Application of ALT in professional education is supported by:

American Nurses Association

The Institute of Medicine

Assumptions of ALT:

- *Adults are relevance oriented*
- *Adults are self-directed*
- *Adults have accumulated a wealth of life experience and knowledge*
- *Adults are task-centered and prefer learning that has immediate application*
- *Adults are motivated to learn*

(Knowles, 1990; Lieb, 1991; McGrath, 2009; Ross-Gordon, 2011; Taylor & Kroth, 2009)

Instruction must be a collaborative experience between student and instructor, demonstrate acknowledgement of the learner's past experiences, have clearly defined and logical objectives, and show practical application to the healthcare environment

(Lee & Daugherty, 2016)

How do we achieve practice change and better patient outcomes with OME?

- What influences transmission of learning to practice?
- What forces sustain or diminish the adherence to practice change?
- What can organizations do to influence the process for achievement of better patient outcomes?

Theoretical Framework: Kirkpatrick Model



- The Kirkpatrick model, in use for over 50 years, is a popular, well-respected, and classic model for evaluating organizational education and training program effectiveness and value
- The model provides a framework for objective evaluation of educational program effectiveness at four outcome levels, and considers the desires of all stakeholders in the learning process

(Rouse, 2011)

Kirkpatrick Model : Level 1 - Reaction

Level 1 determines learner satisfaction regarding program delivery

- Components:

- Instructional methods
- Learning activities
- Teaching materials
- Educational setting
- Overall learner interest in the program



Reaction

(Bindon, 2014; Rouse, 2011; Smidt, Balandin, Sigafos, & Reed, 2009)

Kirkpatrick Model : Level 2 - Learning

Level 2 determines if participants met learning objectives

- Components:

- Knowledge gains
- Skills performance
- Attitudes toward new learning
- Confidence in new knowledge and skills
- Commitment towards use of knowledge and skills in practice



Learning

(Kirkpatrick & Kirkpatrick, 2015)

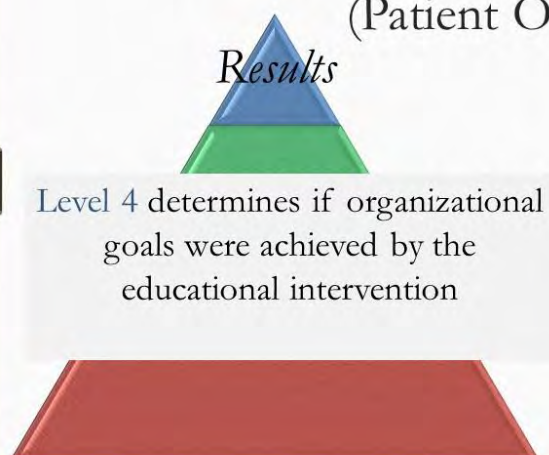
Kirkpatrick Model : Level 3 – Behavior (Practice Change)



- Components:
 - Personal motivators for change
 - Work climate promoters for change
 - Work culture enablers for change
 - Work climate rewards for change
- Level 3 evaluations help Healthcare Organizations determine barriers and drivers of practice change

(Bindon, 2014; Kirkpatrick & Kirkpatrick, 2015; Rouse, 2011)

Kirkpatrick Model : Level 4 – Results (Patient Outcomes)



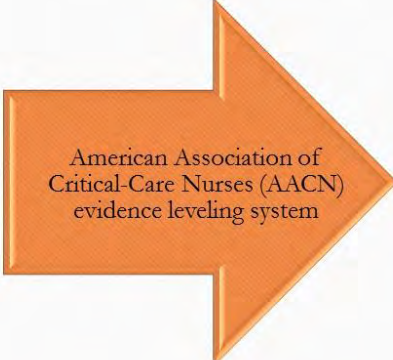
- Components:
 - Evaluation of goal achievement
 - Sustainment of practice change
 - Identification of barriers to sustained change
- Level 4 evaluations help Healthcare Organizations measure the extent of achievement of desired outcome

(Rouse, 2011)

Literature Review: Search Methodology

- Database Selection
 - The Cochrane Library
 - CINAHL
 - PubMed
 - Review of article references
- Main Keywords
 - Nursing
 - Mandatory Education
 - Computer-assisted Instruction
 - Clinical Competence
- Results
 - 574 Articles published between January 1st, 2010 and May 31st, 2016
 - 64 Received full-text evaluation
 - 26 articles used for Literature Review
- Characteristics
 - 10 Randomized Controlled Trials (RCTs)
 - 6 Descriptive Studies
 - 6 Literature Reviews or meta-analyses

Evaluating Evidence Quality



American Association of
Critical-Care Nurses (AACN)
evidence leveling system

- **Level A:** Meta-analysis of RCTs with consistent findings
- **Level B:** RCTs with consistent results
- **Level C:** Qualitative studies. RCTs with inconsistent results
- **Level D:** Professional organization standards
- **Level E:** Expert Review

(Armola et al., 2009)

**Literature
Review**

Generational Considerations

Research Findings

- 62% of all generations preferred lecture for professional education
 - Millennials prefer lecture the most of any generational group
- 65% of all generations preferred compliance education to be online
- 50% preferred demonstration for skills training
- Majority of RNs preferred a combination of online/lecture (blended learning) versus online only

(Pilcher & Bedford, 2011)

**Computer experience, more
than age, was the primary
driver for learner satisfaction
and success with OME**

Generational Considerations

Recommendations

- Add printing options to OME
 - Printable summary for reference and memory aid
- Augment learning with face-to-face reinforcement
 - Learners want feedback on performance
 - Learners need ability to clarify concepts for understanding
- Provide interactive learning options
 - Videos, case-studies, discussion boards, etc. to deepen understanding
- Offer computer training and technical assistance to all learners
 - Ease access and reduce stress of computer use for those with weaker technology skills

(Bell, 2013; Bindon, 2014; Gallo, 2011; Laughlin, 2012; Paterson, 2010)

Literature Review

Learner Preference Accommodation

Research Findings

- Limiting OME to use of one teaching style limits understanding
- Low engagement methods promote passive, surface learning
- Text-based presentations will have the least success in promoting new learning
- High engagement methods encourage higher-level understanding and application of material
- Knowledge retention is primarily visual and auditory-based

(Lam-Antoniades, Ratnapalan, & Tait, 2009; Militello, Gance-Cleveland, Aldrich, & Kamal 2014)

(Dunn, 2002; Labeau 2013; Phillips 2005)

Consider the desired level of cognitive achievement when making choices regarding interactivity and amount of engagement preferred from the learner audience

Learner Preference Accommodation

Recommendations

- Avoid static presentations
 - Add audio to existing presentations to augment understanding and retention
- Use greater visual, auditory, and kinesthetic elements in new presentations
- Provide learner choice for complex concepts
 - Videos, pictures, diagrams, audio explanations, and simulations
- Embed feedback throughout the module
 - Hyperlink answers to previous learning

(Cook et al., 2010; Galbraith & Fouch, 2007; Pilcher & Bedford, 2011)

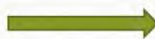
(Carcich & Rafti, 2007; Chang, 2016; Labeau, 2013)

Literature
Review

Online Learning and Topic Suitability

Findings

- Online learning is poor for initial skill training
- Sensitive or ethical topics need learner interaction
- Foreign concepts need high instructor/learner interaction to promote better learning



Recommendations

- Use performance feedback for skill-based OME
- Use methods that encourage learner discussion
- Consider blended approach and high interactivity methods that use multiple active learning strategies

(Du et al., 2013; Klingbeil, Johnson, Totka, & Doyle, 2009; Lahti et al., 2014; Maloney et al., 2011)

(Du et al., 2013; Klingbeil et al., 2009; Lahti et al., 2014; Maloney et al., 2011; Mollon et al., 2012; Phillips, 2005)

Literature
Review

Promoting Learner Satisfaction



- Satisfaction is enhanced with careful considerations toward:
 - Learning style preferences
 - Suitability of content to online delivery
 - Level of interactivity
 - Unique needs of learner audience
- Greater learner satisfaction is associated with dedicated time for learning
- Learning with direct application and relevance to workplace issues will be better received by the learner audience

(Cottrell & Donaldson, 2013; McGrath, 2009; Stout, 2013)

Promoting Learner Satisfaction

Recommendations

- Provide protected time for learning away from other responsibilities
- Provide paid time for learning
- Provide adequate computer resources for learning
- Customize content so that it is relevant to the workplace
- Inform learners about how the information will benefit them in solving issues or problems
- Provide instructor support

(Rankin et al., 2013; Ray & Berger, 2010; Smith, Stolder, Jagers, Fang Liu, & Haedtke, 2013; Stout, 2013)

(Galbraith & Fouch, 2007)

Literature
Review

Promoting Learner Engagement and Learning Retention



- Most studies evaluated cognitive gains via self-report versus objective testing
- Low engagement methods led to limited cognitive gains
- Higher-learning requires a deeper understanding of and engagement with the content
- Higher sensory stimulation allows storage of information in multiple areas of the brain

(Lahti, Hätönen, & Valimäki, 2014; Lau, 2014; Militello et al., 2014; Philips, 2005)

(Labeau, 2013; Phillips, 2005; Pilcher & Bradley, 2013)

**Using objective evaluations,
along with participant
satisfaction, better informs
administrations of the success
of their educational investment**

(Pilcher, 2015)

Promoting Learner Engagement and Learning Retention

Recommendations

- Choose online activities that promote application, analysis, and evaluation level thinking
- Imbed feedback in learning modules
- Engage other senses (visual, auditory, kinesthetic) to enhance retention
- Present short packets of information followed by a review for built-in repetition
- Augment self-report with objective evaluation of knowledge gains
- Provide periodic review of education to boost retention

(Cook et al., 2010; Dunn, 2002; Philips, 2005; Pilcher & Bradley, 2013)

(Kontio et al., 2013; Lau, 2014; Lahti et al., 2014; McCrow et al, 2012)

Promoting Practice Change

Practice change is initiated through education and sustained by processes that support and encourage integration of new learning into daily practice

(Kirkpatrick & Kirkpatrick, 2015)

Literature
Review

Promoting Practice Change



- Few studies evaluated practice change beyond learner self-report
- Most studies evaluated *intention to change* practice versus objective measurement of behavioral change

(Cook et al., 2010; Dunn, 2002; Philips, 2005; Pilcher & Bradley, 2013)

Promoting Practice Change

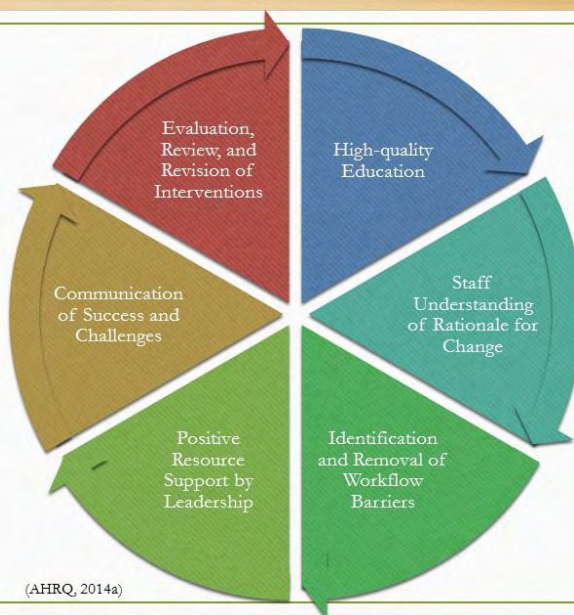
Recommendations

- Provide face-to-face support for clarification and to decrease risk of practice abandonment due to confusion
- Augment learning with knowledge reminders at place of application
- Identify and mitigate barriers to change
- Use workplace projects to move education from theory to practical application
- Relate educational intervention to identified practice gaps and patient implications
- Embed new practice into workflow via electronic medical record (EMR)

(Evatt, Ren, Tuite, & Hravnak, 2014; Rankin et al., 2013; Schroeder et al., 2016; Sherman, Comer, Putnam, & Freeman, 2012)

(Rankin et al., 2013; Schroeder et al., 2016; Stout, 2013; Virani et al., 2009)

Elements of Successful Practice Change



(AHRQ, 2014a)

Literature
ReviewPromoting Achievement of Patient
Outcomes

- Very few studies looked at OME and patient outcomes
- Even less found conclusive evidence linking specific interventions to successful achievements
- This is a large gap in research considering importance of patient outcomes related to practice change and education
- Reimbursement increasingly tied to patient satisfaction and outcomes – drives new research

(Lam-Antoniades et al., 2009; Militello et al., 2014)

Ingredients Required for Achievement of
Successful Patient Outcomes

All criteria for lower three levels must be achieved

Any barriers to practical application of practice change must have been resolved

Staff must have a voice in the process of change

Administration must continue to positively support the new practice

Practice change must be encouraged, rewarded, monitored, and reported

Staff need to be informed about success of efforts

New practices must be reviewed and updated with current research

Learning must be reinforced periodically to augment retention

(AHRO, 2014b; Virani et al., 2009)

Evaluation of Recommendations

- Current nursing research has yet to establish a strong and consistent link between specific interventions and positive outcomes
- Variables in research design methodology and data reporting reduce the overall confidence that the use of one specific method, over another, in providing OME will promote greater results
- The innumerable types of nursing care specialties and unit characteristics present today makes determining interventions that will work for every situation, every time, is impossible

Implications
for Nursing

• Research

- More research is needed using consistent methods
- Head-to-head evaluation of modalities will determine best practice
- Add objective evaluators to better quantify learning achievements
- Evaluate the effect of extrinsic factors on transfer of OME to practice

Implications for Nursing • Education

- Education must be effective and resource conscious
- Nursing Practice Development (NPD) specialists need to maintain competency in current online delivery methods
- Course evaluation criteria needs an objective component
- Online modality choices should be driven by learner audience needs over instructor convenience

(Beattie, Brady, & Tobias, 2013; Pilcher, 2015; Ray & Berger, 2010; Stout, 2013)

Implications for Nursing • Practice

- Practice change does not occur solely through education
- Extrinsic factors and unit culture affect successful transition of OME to practice
- NPD specialists need to collaborate with nursing staff to identify barriers to and drivers for successful change in practice

(AHRO, 2014a; Stout, 2013; Virani et al., 2009)

Implications for Nursing

• Policy

- Education initiatives must receive adequate resource support
- Modality choice must reflect desired level of cognitive achievement
- RN staff need protected time for successful learning
- Organizations must collaborate with all stakeholders to sustain change

(AHRQ, 2014b; Cottrell & Donaldson, 2013; Rankin et al., 2013; Smith et al., 2013; Virani et al., 2009)

Key Points

- OME with high interactivity and feedback promotes active learning and deeper understanding
- Use of a variety of modalities in delivering OME will better personalize content to meet learner needs
- Objective evaluation provides better indication of actual knowledge gains
- Paid time for learning improves satisfaction
- Extrinsic factors significantly affect incorporation of new learning into practice

(Labeau, 2013; Militello et al., 2014; Phillips, 2005)

(Lahti et al., 2014; Schroeder et al., 2016; Virani et al., 2009)

Conclusion

- Future research is needed to determine what specific interventions best meet the needs of the diverse learner audience, achieve participant satisfaction, and result in knowledge retention and application while still maintaining responsible use of resources
- Future research also needs to examine the factors that affect the successful incorporation of OME into nursing practice for the achievement of better patient outcomes

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