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Abstract

Given the imperative of success on the National Council Licensure Examination for Registered Nurses (NCLEX-RN) examination, academic proficiency rather than clinical competence remains the primary focus of nursing education. It is imperative that nursing programs have an intentional remediation plan to provide resources designed to monitor, evaluate and improve clinical competence, distinct from those necessary for academic success. Simulation is an established nursing pedagogy in the development of clinical competency, as it facilitates and grounds the application and reinforcement of abstract and theoretical concepts. and may be useful as a formative strategy when students show faltering clinical proficiency. Clinical and academic competency are both essential for successful completion of an undergraduate nursing program. When students struggle to perform academically, remediation efforts have often targeted academic rather than clinical proficiency given the imperative of NCLEX-RN examination success. Few nursing programs have clinical remediation plans designed to provide support for development and remediation of the more subjective and variable elements of clinical competence. And little is known about how clinical remediation may improve academic performance. One result is students who are succeeding academically despite being marginally prepared to effectively execute the role of professional registered nurse. However, a review of literature revealed a dearth of studies exploring simulation as a tool for clinical remediation in undergraduate nursing education. Using Kolb's Experiential Learning theory as a framework, the purpose of this project was to evaluate the impact of simulation on clinical competency in students with identified clinical deficiencies. A pilot study was done using a quasi-experimental pre-test post-test design to evaluate the effects of an extra simulation on clinical competency in 33 undergraduate nursing students who were divided into control or intervention groups.

Statistical analysis indicated that although both groups demonstrated improved clinical competence scores after participating in the course simulations, the intervention group did not evidence improvement beyond that of the control group after participating in an extra simulation. Further study is necessary to validate the use of simulation for clinical remediation to foster development of nursing graduates who are fully prepared to begin nursing practice.

Keywords: Clinical competence, clinical remediation, simulation

Simulation as a Clinical Remediation Strategy for Undergraduate Nursing Students

Preparing for the professional role of a registered nurse requires completion of a rigorous academic program that includes the acquisition and subsequent practical application of both knowledge and skills in a variety of clinical settings. In the clinical portion of nursing education, students are required to provide care for high acuity patients in an increasingly complex healthcare environment. To demonstrate clinical competence, they must synthesize and apply theoretical content from didactic learning (Lynn & Twigg, 2011). However, given the imperative of success on the National Council Licensure Examination for Registered Nurses (NCLEX-RN) examination, academic proficiency rather than clinical competence remains the primary focus of nursing education. At the program level, penalties from accrediting bodies and the National Council of State Boards of Nursing (NCSBN) drive the demand for academic remediation if pass rate benchmarks are not attained (NCSBN, 2011). Consequently, academic deficiencies have traditionally been met with focused remedial attention such as tutoring, test-taking strategies, and review courses (Mee & Schreiner, 2016). But what about those students who perform well academically, but are not adept in clinical application? Two potential risks include that such students may continue to progress through coursework, meet program requirements and pass the NCLEX-RN with neither development nor sensitive evaluation of essential clinical competence (Benner, 2015; Brown, Neudorf, Poitras & Rodger, 2007; Butler et al., 2011; Lynn & Twigg, 2011). A recent study by Kavanagh and Szweda (2017) identified a major gap between the knowledge required to pass the NCLEX-RN exam, which evaluates only the cognitive domain of learning, and that which is necessary to practice safely and competently (Bensfield, Olech, & Horsley, 2012). In fact, Patricia Benner (2015) in *Educating Nurses: A Call for Radical Transformation Five Years Later,* asserted that while the focus on pass rates is understandable, it has resulted in the graduation of clinicians who successfully pass state licensure but are underprepared for professional practice. Another significant risk for students with clinical deficiencies includes an increased risk for total program failure (Lynn & Twigg, 2011).

To ensure that new graduates are optimally prepared to provide safe, competent clinical care, it is imperative that nursing programs have an intentional remediation plan to provide resources designed to monitor, evaluate and improve clinical competence, distinct from those necessary for academic success (Evans & Harder, 2013). In fact, nurse educators agree thatstudents who are struggling in clinical courses should be offered an opportunity for remediation, but few nursing programs have a well-defined infrastructure in place to implement and evaluate such opportunities (Custer, 2016; Chunta, 2016; Evans & Harder, 2013; Lynn & Twigg, 2011). Reasons for this may include clinical faculty who are challenged by limited experience with initiating remediation, ambiguous policies that lack clear guidelines indicating the need for remediation, and varied or conflicting viewpoints with regard to addressing competency issues (Killam, Luhanga, and Baker, 2011). Conventional remediation practices often involve a learning contract between student and instructor outlining specific objectives which must be met within an allotted time frame (Gallant, MacDonald, and Smith-Higuchi, 2006). Other remediation approaches involve skills practice in the lab setting, additional pre-clinical assignments completed to prepare the nursing student for patient care, formative feedback, and increased supervision in the clinical environment (Chunta, 2016; Haskvitz & Koop, 2004; Hutton & Krull-Sutherland, 2007; Koharchik, Weideman, Walters, & Hardy, 2015; Lewallen & DeBrew, 2012). While many of these strategies have potential utility, their effectiveness for clinical remediation has yet to be determined (Custer, 2016).

Human patient simulators provide realistic practice for students outside of the live clinical setting, and are being used more extensively in nursing education to support clinical skill development in a controlled clinical context (Lynn & Twigg, 2011). Nehring, Ellis & Lashley (2001) posited that simulation could be useful for remediation, since it promotes clinical improvement through repetitive skill practice and reinforcement of concepts. Kathie Lasater (2007), author of the Lasater Clinical Judgement Rubric, which quantifies developmental progression of clinical judgement skills, also affirmed the value of simulation for clinical remediation (personal communication, K. Lasater, September 16, 2017). However, further exploration of nursing literature revealed a paucity of studies measuring the impact of simulation as a tool for clinical remediation.

Problem Statement

There is an identified need in nursing education for remediation strategies that meet the needs of nursing students who are having difficulty developing clinical competency. Innovative remediation strategies must be informed by evidence, tested, and evaluated to be optimally effective (Evans, 2013). Thus, this scholarly project aims to add to the literature on the use of simulation for clinical remediation by evaluating the effect of simulation in a cohort of nursing students with identified clinical deficiencies.

Project Purpose and Objectives

The purpose of this scholarly project is to examine the effectiveness of simulation as a strategy for clinical remediation. A decline in NCLEX-RN pass rates for Belmont University undergraduate nursing students over the past five years has garnered interest in innovative approaches for quality improvement in the preparation, remediation and evaluation of undergraduate nursing students. (T. Legge, personal communication, March 22, 2017).

Evaluating simulation as an intervention for students identified as having clinical deficiencies will contribute to evidence for effective clinical remediation methods with undergraduate nursing students at Belmont University, and improve clinical remediation practices in nursing education.

Project Significance

Employing simulation as a strategy for clinical remediation has the potential to increase clinical knowledge, skills and thinking, thus enhancing students' ability to be successful in the clinical setting first as students and later as safe and competent professional nurses (Hutton & Krull-Sutherland, 2007). While academic deficiencies clearly place students at risk for program failure, students struggling in the clinical setting who do not receive adequate support incur the same risk (Lynn & Twigg, 2011). Personal consequences of program failure can include the tremendous financial burden of an uncompleted degree when student loans remain outstanding (Gladieux & Perna, 2005). Most notably, the student who fails to successfully complete the program of nursing study does not qualify to take the licensure examination, and severely limits their potential for meaningful employment in healthcare. Additionally, student failure not only has financial implications for the program, but rising attrition rates are currently a major contributor to the nursing shortage as fewer qualified graduates enter the workforce (Jeffries, 2007). As nurse educators, we are accountable to our students, to those who have invested in their education and to the patients for whom they will go on to provide care. A clearly defined clinical remediation protocol is an imperative part of early intervention to mitigate the risk of failure for both students and schools of nursing (Chunta, 2016).

Review of Evidence

Historical Background

Various fields have used simulation for training purposes as far back as the 18th century (Bradley, 2006). High-fidelity flight simulation has been used extensively in aviation to improve pilot's skills, as well as space program simulators to prepare and train astronauts (Bradley, 2006). The military has also historically made use of simulation, employing drill techniques such as war games to prepare men and women for combat (Gaba, 2007). Common to each of these professions is the fact that training in real world situations would be dangerous, costly, and unethical if not impossible. Likewise, sending these professionals into high stakes contexts without confirming their readiness and competence for performance carries incredible risks for the professionals and the missions for which they work so hard to prepare.

Use of simulation in clinical medicine has directly contributed to improvements in the quality of medical education which has been linked to improved patient safety and care over the past two decades (Gaba, 2007). Beginning in the late 1960's, the specialty of anesthesia first utilized simulation in the development of a simple human patient simulator for training in cardio-pulmonary resuscitation (CPR) (Bradley, 2006). Since then, multitudes of medical personnel as well as laypersons have been certified in CPR on similar devices. Medical education has also preceded nursing education in the use of simulation for clinical remediation. Examples can be found in the specialty areas of anesthesia, emergency medicine, medical administration, neurology, obstetrics, nephrology, immunology and surgery (Chou, Chang, & Hauer, 2008; Gaba, 2007; Gas, Buckarma, Mohan, Pandian, & Farley, 2016; Patterson & Geis, 2013; Sanfey, Williams, & Dunnington, 2013; Stirling et al., 2012; Williamson, Quattromani, & Aldeen, 2016).

A study of anesthesiology programs by Rochlen et al. (2016) found that forty percent used simulation for resident assessment and remediation.

Simulation in Nursing Education

Simulation is well established as a nursing pedagogy, and is employed widely in schools of nursing to foster knowledge application, critical thinking and clinical judgment, which are critical components of clinical competency (DeBourgh & Prion, 2011; Decker, Sportsman, Puetz, & Billings, 2008; Fisher & King, 2013; Lejonqvist, Eriksson, & Meretoja, 2016; Lewis, Strachan, & Smith, 2012; Lynn & Twigg, 2011; Wolfgram & Quinn, 2012). Perhaps the strongest evidence supporting simulation as a means of developing clinical competence is the recent results of the NCSBN simulation study (Alexander et al., 2014). The findings of this longitudinal study support the substitution of simulation for up to fifty percent of clinical hours in current nursing curricula (Alexander et al., 2014). This research provides evidence that simulation is comparable to patient care in the actual clinical setting and lends credibility to simulation as a valuable modality in teaching the clinical aspects of nursing.

Several studies have reported the advantages of using simulation by highlighting its strength in linking nursing theory to clinical practice (Decker et al., 2008; Evans & Harder, 2013; McCaughey & Traynor, 2010; Weaver, 2011). Value, realism, and increased student knowledge have been identified as other benefits from simulation (Weaver, 2011). Literature also suggests that simulation improves student confidence and self-efficacy but how these qualities translate to competence in practice has not been well established (Cantrell, Franklin, Leighton & Carlson, 2017; Weaver, 2011). However, few recent descriptions of clinical remediation programs have been recently documented, and only seven articles published since 2000 described or reviewed the use of simulation for remediation in undergraduate nursing education (Bensfield et al., 2012;

Chunta, 2016; Evans & Harder, 2013; Haskvitz & Koop, 2004; Leach, 2014; Lynn & Twigg, 2011; Wolfgram & Quinn, 2012). Each of these studies reported improved student clinical performance after the remediation experience using simulation. Specific clinical skills improved with simulation including critical thinking and problem solving, (Bensfield et al., 2012; Chunta, 2016) clinical judgment (Evans & Harder, 2013), and competency in assessment and clinical skills (Leach, 2014; Wolfgram & Quinn, 2012). Also of note was a repeated theme that simulation can be used to detect clinical incompetence in students who may otherwise be excelling academically (Bensfield et al., 2012; McCaughey & Traynor, 2010; Rizzolo, Kardong-Edgren, Oermann, & Jeffries, 2015). Additionally, there is some evidence to validate the effective transfer of clinical competency from simulation to the clinical setting (Kirkman, 2013). Although a recent review of the literature identified a need for additional objective evidence obtained through the use of reliable and valid measurement tools to evaluate the impact of simulation on clinical practice (Cantrell et al., 2017).

Theoretical Model

Overview

Kolb's (1984) Experiential Learning Theory (ELT) was used as a foundation for this project's emphasis on the effectiveness of simulation as a clinical remediation tool for undergraduate nursing students. The principles of ELT are built on the educational philosophy of American philosopher and educator John Dewey, who contributed to the transformation of traditional higher education methods in the 1930's by asserting the necessary relationship between experience and education (Fowler, 2008). The work of Kurt Lewin, founder of American social psychology and Jean Piaget, a developmental psychologist also influenced Kolb and the development of ELT (Kolb, 1984). These pioneers in the study of human behavior and learning presented new theories stating that learning happens through experiences, and thereby have potential to change the way one thinks and behaves. Additionally, learners draw on prior experiences to make connections resulting in new knowledge (Kolb, 1984).

Theory Constructs and Assumptions

Kolb drew from these philosophies and developed a model for learning which includes four essential phases: abstract conceptualization, active experimentation, concrete experience, and reflective observation (Kolb, 1984). The learner must participate in each phase in order for learning to take place. First, the learner must be engaged in a concrete experience before he or she will contemplate their actions during reflective observation. Next, in abstract conceptualization, the learner thinks about and assigns meaning to the learning experience. Here, consideration is given to what may have been done differently to improve the outcome. In the final phase of active experimentation, the learner uses what was learned to guide future behavior. The assumption of ELT is that learning occurs at a more complex level each time a learner completes the cycle; repetition deepens understanding which hastens mastery or competency (Kolb, 1984). (See Figure 1 for a model of Experiential Learning Theory).

Kolb recognized that individual learning styles are an important part of the learning cycle, and described four types of learners: divergent, assimilating, converging and accommodating (Kolb, 1984). Based on individual learning styles, learners will show a preference and perhaps perform better in one or two of the learning phases. However, ELT presents a method by which all learning preferences are accommodated. Moreover, the learner's active participation in each of the phases creates an ideal milieu for integrated learning.

Theory Application

ELT emphasizes the importance of clinical practice as a valid and reliable educational process for students enrolled in certain professional studies, particularly medical and nursing education. For example, Poore, Cullen and Schaar (2014) found that use of ELT maximized the learning process for individual nursing students during an interprofessional education simulation. Lisko and O'Dell (2010) used ELT to evaluate how well nursing students in a medical-surgical nursing course integrated critical thinking and laboratory skill performance. Student evaluations reflected that simulation was beneficial to the integration of theory and psychomotor skills in nursing. One study, designed to use simulation to enhance nursing student knowledge and attitudes about diabetes self-care, found that experiential learning opportunities promoted student learning and understanding (Fenske, Freeland, Price and Brough, 2015). Howard, Englert, Kameg and Perozzi (2011) used ELT as a framework to successfully integrate simulation across an undergraduate nursing curriculum. Faculty evaluated experiential based learning as a sound model for assisting students to apply theoretical knowledge in the practice setting (Howard et al. 2011). Finally, a study by Chmil, Turk, Adamson and Larew (2015) found that students engaged in a simulation using experiential learning design had improved clinical judgement scores over students who were engaged in traditional clinical learning. This evidence supports the premise of ELT as integral to clinical education.

Simulation offers a concrete learning experience that results in the acquisition of new knowledge as connections are made during post-simulation reflection. ELT is an appropriate choice for the scholarly project design, as it facilitates the engagement of participants in each element of the learning cycle described by Kolb through simulation. Debriefing after the simulation provides for reflection so that learners can intentionally think about experiences and connect abstract principles to form new learning. This new learning then translates to the live clinical setting in the form of improved clinical competency. Evidence supports ELT as a method by which all learning styles are addressed during the various phases of the cycle, meeting the individualized needs of each learner as they actively participate.

Previous studies indicate that the nursing learning process is enhanced with the use of simulation teaching methods and can increase critical thinking and laboratory skill performance (Lisko and O'Dell, 2010; Poore et al., 2014). These results are supported by ELT which posits that individual learning should be assisted through experiences and can impact education and behavior (Fowler, 2008; Kolb, 1984). Therefore, the project leader hypothesizes that participating in an extra simulation will improve clinical competency scores in students with identified clinical deficiencies. Additionally, it is hypothesized that students participating in an extra simulation will have scores that improve significantly more than students not participating in an extra simulation.

Project Design

This scholarly project utilized a quasi-experimental pre-test, post-test design to evaluate the impact of an extra simulation on the clinical competence of students with identified clinical deficiencies. Subjects were undergraduate nursing students in an adult health clinical course at Belmont University. The use of an established pedagogical intervention to improve education made it very low risk to student participants; the project was approved and exempt from full review by the Belmont University Institutional Review Board.

Project Setting

Implementation of the scholarly project occurred in the simulation center of the Gordan E. Inman College of Health Sciences (CHS) at Belmont University in Nashville, Tennessee. The CHS simulation center includes six simulation laboratories housing a total of 32 human patient simulators. The project took place in one of the simulation laboratories using three high-fidelity human patient simulators. Bedside monitors were used to register oxygen saturation levels via pulse oximetry. Each of the laboratories is designed to replicate a hospital room setting and includes functional equipment such as compressed air and suction, intravenous pumps, a medication administration unit, and computers with electronic medical records.

Simulation is a routine learning activity across the undergraduate nursing curriculum at Belmont University, and all student participants in the project were familiar with the simulators and the use of simulation in their course work.

Project Sample

Purposive sampling was used to identify 93 students enrolled in the Adult Health I clinical course at Belmont University during the fall semester of academic year 2017-2018. The adult health I course is the second medical-surgical clinical course and occurs in the third semester of a six-semester Baccalaureate nursing program. In this course, students are required to move from a basic understanding of theoretical content to engagement in more complex applications of abstract concepts to practice. As a result, it is often during the Adult Health I course that evidence of deficiencies in clinical competence begin to surface as illustrated by the fact that 65% of clinical course failures in the last five years at Belmont occurred in this course (personal communication, B. Sidwell, 2017).

Eighty-nine students completed the project survey and 86 consented to have their data included in the project. Six students were excluded from the project because they did not participate in the first simulation, which left 80 students. Four students completed the optional simulation on the same day as the intervention group and were excluded from project results to further reduce introduction of bias. The final number of total project participants was 76 with 74 completing the demographic survey.

Scores on the first simulation were reviewed and scores </=16/21 were identified as at risk for clinical deficiency and course failure. Thirty-six students scored 16 or less and met eligibility criteria for inclusion in the project sample.

All thirty-six students were notified that they were required to attend an extra simulation to meet course objectives. These 36 were sent an electronic link with an invitation to sign up for the extra simulation on one of two dates. Self-selection of simulation date assigned each student to either the control or intervention group. From this sample, 34 of the 36 students had consented to have their data used for the project. One subject in the intervention group was removed due to outlier analysis, leaving a total of 33 students who were divided between intervention (n = 18) and control (n = 15) groups. All project participants were blind to group assignment and an optional extra simulation was offered to the students not included in the project sample to protect confidentiality.

Data Collection Instruments

The Creighton Competency Evaluation Instrument (CCEI) was used for the standardized evaluation of clinical competence during the project and has been used to evaluate participant performance during simulation for approximately two years in the school of nursing at Belmont University. Faculty and student familiarity with the CCEI contribute to its usefulness in the assessment of nursing students in simulation settings. The CCEI has undergone extensive validity, inter- and intra-rater reliability testing during its development and subsequent studies and is an established evaluation tool for clinical and simulated settings (Adamson et al., 2011;

Hayden, Keegan, Kargong-Edgren & Smiley, 2014; Parsons et al., 2012; Rizzolo et al., 2015). Developers of the tool report interrater reliability calculated using intra-class correlation (2,1) and 95% confidence interval, to be 0.952 (0.697, 0.993) (Adamson et al., 2011). The intrarater reliability, calculated using intra-class correlation (3,1) and 95% confidence interval was 0.883, and the internal consistency, using Cronbach's alpha, was 0.979 (Adamson et al., 2011).

The evaluative framework of the CCEI is based on the American Association of Colleges of Nursing (AACN) (2008) core competencies and includes critical thinking, communication, assessment, and technical skills (Todd, Manz, Hawkins, Parsons, and Hercinger, 2008). Twenty-three behaviors are identified as essential to include in evaluation of clinical competency and assigned to one of each of the four categories. Scoring is displayed on a dichotomous scale which evaluates "does not demonstrate competency" as a zero, and "demonstrates competency," as a one. Agreement by simulation facilitators as to which behaviors are applicable and essential to meet during the simulation is imperative to accurately use the instrument (Todd et al., 2008). The project director and adult health clinical course coordinator collaboratively identified minimum expected behaviors of participants during the simulation, evaluating each item on the CCEI for relevance to the simulation. This procedure aligns with the intended use of the tool by its developers (Todd et al., 2008). In addition, two hours of intensive training on use of the CCEI was conducted with the clinical instructors who would score participants prior to implementing the pilot study. Further clarifications regarding student expected behaviors were discussed and agreed upon during the training. Improvement in instrument use and reliability scoring is a documented outcome after formal training (Adamson et al., 2011; Cockerham, 2015; Parsons et al., 2012; Rizzolo et al., 2015)

Data Collection Process

Data was collected using Qualtrics, a web-based survey technology to consent project participants and to capture demographic information. A link to the survey was made accessible to all Adult Health I students during their weekly scheduled class period in September 2017.

Adult Health I instructors evaluated clinical students using the CCEI during the first adult health I course simulation in September 2017. Students' raw scores served as the pre-scores for the study. The intervention group completed the extra simulation before the second course simulation, and the control group completed the extra simulation after the second course simulation. Adult Health I instructors then re-evaluated clinical students using the CCEI during the second course simulation in October 2017. Students' raw scores served as the post-scores for the project. All scores were entered into the project dataset that contained the Qualtrics data by the project leader.

Statistical Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) 25.0 statistical analysis software including descriptive analysis, χ^2, independent *t* test and paired *t* test. Normality was assessed for the class, intervention, and control group's pre-and post-CCEI scores using the Skewness and Kurtosis statistics and their standard errors. Although these measures did not display normality in all groups, visual inspection of the data on plots and charts and evaluation of skewness and kurtosis measures led to a determination that parametric methods were appropriate to use in this project (Field, 2013; Havlicek & Peterson, 1974). The distributions of pre-and post-CCEI scores were both negatively skewed indicating skewness toward higher scores.

Power was assessed a priori using G*Power to determine a sample size of 128 was required to detect a medium effect size 0.50, $\alpha = 0.05$, power = 0.80 with the independent *t* test.

Post hoc power analysis $\alpha = 0.05$, n (18, 15), determined this test to have a power = 0.60 to detect an effect size of 0.8 (Erdfelder, Faul, & Buchner, 1996).

Power was assessed a priori using G*Power to determine a sample size of 34 was required to detect a medium effect size 0.50, $\alpha = 0.05$, power = 0.80 with the paired *t* test. Post hoc power analysis $\alpha = 0.05$, n (18), determined this test to have a power = 0.52 to detect an effect size of 0.5. Post hoc power analysis $\alpha = 0.05$, n (15), determined this test to have a power = 0.44 to detect an effect size of 0.5 (Erdfelder et al., 1996).

Results

Descriptive statistics for the class, control, and intervention groups are presented with group difference statistics in Table 1. Analysis was performed to determine any group differences in demographic characteristics between the intervention and control groups. A significant difference for age was detected using a one-way ANOVA ($F(1,30) = 4.40$; $p = .04$) between the intervention group (m=21.06; SD 1.35) and control group (m=20.27; SD .594). The total class sample (n = 76) had a mean age of 20.82 (SD 1.44) and consisted of 88.2 percent females and 9.2 percent males. Degrees earned among the class included 93 percent who had no prior degree, 2.6 percent had an Associate's degree, and 1.3 percent had a Bachelor's degree. Students in the traditional program of study made up 57.9 percent of the class, transfer students were 13.2 percent, 15.8 percent were students from a partner university program and 10.5 percent of students were in an accelerated program of study.

An independent samples *t*-test indicated no statistically significant difference in the mean CCEI pre-scores between the control group (M=14.80, SD=1.52) and the intervention group

(M=14.61, SD=0.98, t (31) = -.431, p = 0.67, d = -0.15) prior to the intervention (see Table 2) (Cohen, 1988). Levene's test also suggested homogeneity between groups F (17,14) = 1.08, p = 0.31. Paired samples t-tests showed significant improvement in CCEI scores for both intervention and control groups after the second course simulation (see Table 2). Intervention group post-CCEI scores were (M = 16.78, SD = 3.00). Pre CCEI-scores were (M = 14.61, SD = 0.98; t (17) = 2.75, p = .014, d = .65). Control group post CCEI scores were (M = 17.93, SD = 2.60) compared to the CCEI pre-scores (M = 14.80, SD = 1.52), t (14) = 2.75, p = .003, d = 0.94; see Table 2). However, an independent samples t-test indicated no significant difference in the intervention group CCEI post-scores (M=16.78, SD=3.00) and the control group CCEI post-scores (M=17.93, SD=2.60) conditions: t (31) =-1.70, p = 0.252; d=-0.41.

A separate paired-samples t-test was conducted to determine the change in scores for the students who scored greater than 17 on the first course simulation and were therefore not eligible for the intervention. Results indicated a significant decrease in mean CCEI post-scores from CCEI pre-scores. Post CCEI scores: M = 17.51, SD = 2.53. Pre-test CCEI scores: M = 18.28, SD = 1.26, t (42) = 2.75, p = .04, d = -0.33. See Figure 2 for mean CCEI pre and post-scores by group.

Discussion

Mean CCEI scores in both the intervention and control groups increased after participation in simulation, supporting the hypothesis that simulation improves clinical competency scores. This increase in scores has both clinical and statistical significance, as the improvement moved the students in both groups from a failing score to a passing score on the simulation (<76%, to 80% and 85% respectively). Findings align with prior research which affirms simulation as effective in improving integral components of clinical competency such as critical thinking and clinical decision-making (Birkhoff & Donner, 2010; Cant & Cooper, 2010; Fisher & King, 2013; Lejonqvist et al., 2016; Lewis et al., 2012; Rhodes & Curran, 2005).

Exposure to simulation

There was a lack of support for the second hypothesis that CCEI scores would improve more in the intervention group than in the control group which could be explained by an insufficient amount of simulation used as the intervention for remediation. Other studies which have evaluated the use of simulation as a tool for clinical remediation incorporated at least three simulation encounters, and clinical competency improved after repeated exposure. (Bensfield et al., 2012; Gas et al., 2016; Leach, 2014; Lynn & Twigg, 2011). Sullivan-Mann, Perron and Feller (2009) found that critical thinking scores increased relative to participation in simulation which could suggest that improvements in clinical judgement or critical thinking precede changes in behavioral competencies. Other experts noted that two to three simulations were sufficient to remediate most deficiencies with their clinical students (Haskvitz and Koop, 2004). Similar results might have been demonstrated in this project by using repetitive simulations over a longer period of time. This assertion is supported by Kolb (1988) who advised that repetition facilitates deeper learning and the development of competency.

Clinical experience

The finding of control group CCEI scores improving more than intervention or class CCEI scores was curious and is difficult to explain, given the analysis of homogeneity in groups prior to the intervention. All students enrolled in the course were exposed simultaneously to various learning activities, both clinical and didactic, that were designed to meet course objectives and could have influenced student performance on the simulation. Distinct clinical experiences for students which occurred concurrently with the project may have impacted outcomes. Diverse clinical sites as well as different clinical instructors are other variables that influence student development during the course and could have confounded results of competency evaluation.

Student motivation

A final finding was that students who were in the rest of the class and not in either the intervention or control group had lower CCEI scores after the second course simulation while students in intervention and control groups improved. Perhaps the motivation for preparing and performing well during the second simulation declined after receiving high scores on the first simulation and is reflected in results. Motivation has been cited as a factor which could impact student success during simulation (Blum, Borglund and Parcells, 2010; Evans and Harder, 2013).

Complexity of competency evaluation

Experts in competence evaluation in nursing have described the process as subjective, inconsistent, and “rife with problems,” and therefore recommend using various evaluation methods for best practice (Oermann, Yarbrough, Saewert, Ard, and Charasika, 2009). Factors such as faculty comfort with evaluation, the differences in evaluating a student during a simulation versus the live clinical setting, and the variability of student performance on a given day present multiple confounding variables for evaluating clinical competency. These variables are present and influential despite the use of valid and reliable instruments such as the CCEI (Rizzolo et al., 2015). Ideally, capturing a complete picture of clinical competency includes both qualitative and quantitative measures where evaluations are repeated over time to measure improvement (Lejonqvist et al., 2016). Because this project was designed as a pilot to test simulation as a remediation strategy, faculty resources and time constraints limited the scale of the project to a single intervention exposure. However, the intervention was situated in the larger course where more comprehensive evaluation took place as the semester progressed.

Implications and Recommendations

The findings from this project are consistent with others in the literature supporting simulation as an effective method for development of clinical competency in undergraduate nursing students. However, recognizing the lack of significant improvement in the intervention group over control group after an extra simulation, additional research on the timing and intervals at which simulation is offered may help optimize its use as a tool for remediation in undergraduate nursing education.

Sample Size

A larger sample size would improve the ability to detect the effect of simulation on clinical competency. While the small sample size in this project was appropriate for pilot testing aimed at determining feasibility, scaling the intervention to a larger sample over a longer time period would offer the opportunity for repeated measures of clinical competency. A larger sample size and multiple site testing would also increase the generalizability of the results.

Targeted Remediation

Although this project used the same simulation for all students who had clinical deficiencies, remediation using simulations which target observed student deficits has been shown to improve clinical performance (Chunta, 2016; Gallant et. al, 2006; Hutton and Krull-Sutherland, 2007). A targeted approach would allow subgroups of students who show common deficiencies to participate in simulations designed to remediate those deficiencies in a controlled environment that includes immediate feedback. While individualized remediation would be ideal, limitations related to scalability, cost-effectiveness and burden on faculty resources make it impractical. Sustainable remediation programs must be adaptable to meet multiple student needs while maintaining cost-effectiveness.

Amount of Simulation

Additionally, more simulation interventions for students identified with clinical deficiencies are recommended as an approach for effective remediation. Subsequent simulations could narrow in scope and focus more intensely on student's weakest areas. Participating in a greater number of simulations would also provide increased opportunity for student assessment, which supports best practices in evaluation. There is a need in simulation research for more studies which focus on the number of simulated experiences needed to see a measurable change in clinical competency.

Strengths and Limitations

This project was designed to pilot the use of simulation as a remediation strategy within an undergraduate nursing program. The project leader had hoped to present evidence to support the use of simulation as a standard early intervention for students struggling to demonstrate clinical competency. However, several limitations noted in the study design and implementation make it difficult to propose clear recommendations at this time.

For example, the fact that subjects are students enrolled in a course of study with defined learning objectives means that they are also exposed to varied clinical experiences and diverse faculty expertise designed to impact the development of clinical competency. Thus, evaluation naturally includes subjective expert faculty assessment, which is necessary and valuable in formative learning. The CCEI is a valid and reliable instrument designed for use in simulation or clinical and no evaluation instrument is intended to be used in isolation when comprehensive evaluation is the goal. Competency in this study was measured at one point in time and further student progress throughout the semester was not captured. Additional studies are necessary to quantify the transfer of competencies gained in simulation to a live clinical setting and to determine ideal intervals for the assessment of improvement. Finally, students self-selected dates which assigned them to either the intervention or control group which could have introduced selection bias. A pure research design in which all confounding variables are controlled is difficult to achieve in the context of nursing education and would not be realistically replicable for sustainable practice.

Conclusion

A plan for remediation of undergraduate nursing students who have clinical deficiencies must be actualized to maximize student success and bridge the widening gap for readiness to practice. Use of simulation for clinical remediation is based on its demonstrated success in fostering the development of critical thinking and clinical competency. Simulation allows application of theory to practice and can be beneficial in enhancing the potential of students to be successful in clinical preparation and completing an undergraduate program. Development of clinical competence should be of the highest priority for nurse educators in the interest of supporting students throughout the nursing program and ultimately to positively impact patient outcomes.

References

Adamson, K. A., Parsons, M. E., Hawkins, K., Manz, J. A., Todd, M., & Hercinger, M. (2011). Reliability and internal consistency findings from the C-SEI. *Journal of Nursing Education*, *50*(10), 66-73. http://doi.org/10.3928/01484834-20110715-02

Alexander, M., Kardong-edgren, S., & Morvant, B., Hayden, J., Smiley, R., Jeffries, P. (2014). Regulation. *Journal of Nursing Regulation*, *5*(2), S4-S41.

American Association of Colleges of Nursing. (2008). *The essentials of baccalaureate education for professsional nursing practice* [Fact sheet]. Retrieved from www.aacn.nche.edu/publication/order-form/baccalaureate-essentials

Benner, P. (2015). *Educating nurses: A call for radical transformation five years later.* Northeast Ohio Deans' Rountable 10th Anniversary Conference, Cleveland, OH.

Bensfield, L. A., Olech, M. J., & Horsley, T. L. (2012). Simulation for high-stakes evaluation in nursing. *Nurse Educator*, *37*(2), 71–74. http://doi.org/10.1097/NNE.0b013e3182461b8c

Birkhoff, S. & Donner, C. (2010). Enhancing pediatric clinical competency with high-fidelity simualtion. *Journal of Continuing Education in Nursing, 41*(9), 418-423. doi: 10.3928/00220124-20100503-03

Blum, C., Borglund, S., & Parcells, D. (2010). High-fidelity nursing simulation: Impact on student self-confidence and clinical competence. *International Journal of Nursing Education Scholarship, 7*(1), 1-14. doi:10.2202/1548-923X.2035

Bradley, P. (2006). The history of simulation in medical education and possible future directions. *Medical Education*, *40*(3), 254–262. http://doi.org/10.1111/j.1365-2929.2006.02394.x

Brown, Y., Neudorf, K., Poitras, C. & Rodger, K. (2007). Unsafe student clinical performance calls for a systematic approach. *Canadian Nurse, March,* 29-33.

Butler, M.P., Cassidy, I., Quillinan, B., Fahy, A., Bradshaw, C., Tuohy, D., & Tierney, C., (2011). Competency assessment methods - tool and processes: A survey of nurse preceptors in Ireland. *Nurse Education. Practice. 11* (5), 298e303. http://dx.doi.org/10.1016/j.nepr.2011.01.006

Cant, R. & Cooper, S. (2010). Simulation-based learning in nurse education: Systematic review. *Journal of Advanced Nursing. 66*(1), 3-15. doi: 10.1111/j.1365-2648.2009.05240.x

Cantrell, M.A., Franklin, A., Leighton, K., & Carlson, A. (2017). The evidence in simulaiton-based learning experiences in nursing educaiton and practice: An umbrella review. *Clinical Simlation in Nursing, 13*(634-667). http://dx.doi.org/10.1016/j.ccns.2017.08.004

Chmil, J., Turk, M., Adamson, K., & Larew, C. (2015). Effects of an experiential learning simulation design on clinical nursing judgment development. *Nurse Educator, 40* (5), 228-232. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=rzh&AN=110359223&site=ehost-live

Chou, C. L., Chang, A., & Hauer, K. E. (2008). Remediation workshop for medical students in patient-doctor interaction skills. *Medical Education*, *42*(5), 537. http://doi.org/10.1111/j.1365-2923.2008.03055.x

Chunta, K. (2016). Ensuring safety in clinical: Faculty role for managing students with unsafe behaviors. *Teaching and Learning in Nursing*, *11*(3), 86–91. http://doi.org/10.1016/j.teln.2016.03.001

Cockerham, M. E. (2015). Effect of faculty training on improving the consistency of student assessment and debriefing in clinical simulation. *Clinical Simulation in Nursing*, *11*(1), 64–71. http://doi.org/10.1016/j.ecns.2014.10.011

Cohen, J. (1988) *Statistical power analysis for the behavioral sciences.* United States of America: Lawrence Erlbaum Associates.

Custer, N. (2016). Remediation 101: Strategies for nurse educators. *Teaching and Learning in Nursing*, 1-5. http://doi.org/10.1016/j.teln.2016.05.006

DeBourgh, G. A., & Prion, S. K. (2011). Using simulation to each prelicensure nursing students to minimize patient risk and harm. *Clinical Simulation in Nursing*, *7*(2), e47–e56. http://doi.org/10.1016/j.ecns.2009.12.009

Decker, S., Sportsman, S., Puetz, L., & Billings, L. (2008). The evolution of simulation and its contribution to competency. *The Journal of Continuing Education in Nursing*, *39*(2), 74–80. http://doi.org/10.3928/00220124-20080201-06

Erdfelder, E., Faul, F., & Buchner, A. (1996). GPOWER: A general power analysis program. Behavior Research Methods, Instruments, & Computers, 28, 1-11.

Evans, C. J., & Harder, N. (2013). A formative approach to student remediation. *Nurse Educator*, *38*(4), 147–51. http://doi.org/10.1097/NNE.0b013e318296dd0f

Fenske, C., Freeland, B., Price, D., & Brough, E. (2015). Using experiential learning to enhance nursing student knowledge and attitudes about diabetes self-care. *Journal of Nursing Education and Practice, 5* (12), 104-110. Retrieved from http://www.sciedupress.com/journal/index.php/jnep/article/view/72

Field, A. (2013). *Discovering statistics using SPSS.* 4th ed. London: Sage.

Fisher, D., & King, L. (2013). An integrative literature review on preparing nursing students through simulation to recognize and respond to the deteriorating patient. *Journal of Advanced Nursing*, *69*(11), 2375–2388. http://doi.org/10.1111/jan.12174

Fowler, J. (2008). Experiential learning and its facilitation. *Nurse Education Today, 28* (4), 427-433. doi: 10.1016/j.nedt.2007.07.007

Gaba, D. M. (2007). The future vision of simulation in healthcare. *Simulation in Healthcare : Journal of the Society for Simulation in Healthcare*, *2*(2), 126–135. http://doi.org/10.1097/01.SIH.0000258411.38212.32

Gallant, M., MacDonald, J.A., & Smith-Higuchi, K. (2006). A remediation process for nursing students at risk for clinical failure. *Nurse Educator*, *31*(5), 223–7. http://doi.org/10.1097/00006223-200609000-00010

Gas, B. L., Buckarma, E. H., Mohan, M., Pandian, T. K., & Farley, D. R. (2016). Objective assessment of general surgery residents followed by remediation. *Journal of Surgical Education*, *73*(6), e71–e76. http://doi.org/10.1016/j.jsurg.2016.07.002

Gladieux, L. & Perna, L. (2005). Borrowers who drop out. A neglected aspect of the college student loan trend. The National Center for Public Policy and Higher Education Repor www.files.eric.ed.gov

Haskvitz, L. M., & Koop, E. C. (2004). Students struggling in clinical? A new role for the patient simulator. *Educational Innovations*, *43*(4), 181–184.

Havlicek, L. L., & Peterson, N. L. (1974). Robustness of the t test: A guide for researchers on effect of violations of assumptions. Psychological Reports, 34(3, Pt 2), 1095-1114.

Hayden, J., Keegan, M., Kargong-Edgren, S., & Smiley, R. (2014). Reliability and validity testing of the Creighton Competency Evaluation Instrument for use in the NCSBN National Simulation Study. *Nursing Education Perspectives, 35*(4), 244-252. doi: 10.5480/13-1130.1

Howard, V. M., Englert, N., Kameg, K., & Perozzi, K. (2011). Integration of simulation across the undergraduate curriculum: Student and faculty perspectives. *Clinical Simulation in*

Nursing, *7*(1), e1–e10. http://doi.org/10.1016/j.ecns.2009.10.004

Hutton, J. A., & Krull-Sutherland, R. E. (2007). Clinical remediation in a nursing program. *Teaching and Learning in Nursing*, *2*(3), 68–71. http://doi.org/10.1016/j.teln.2007.04.003

Jeffreys, M. (2007). Tracking students through program entry, progression, graduation, and licensure: Assessing undergraduate nursing student retention and success. *Nurse Education Today, 27*(5), 406-419. doi: 10.1016/j.nedt.2006.07.003

Kavanagh, J. & Szweda, C. (2017). A crisis in competency: The strategic and ethical imperative to assessing new graduate nurses' clinical reasoning. *Nursing Education Perspectives, 38* (2), 57-61. doi: 10.1097/01.NEP.0000000000000112

Killam, L., Luhanga, F., & Bakker, D. (2011). Characteristics of unsafe undergraduate nursing students in clinical practice: An integrative literature review. *The Journal of Nursing Education*, *50*(8), 437–446. http://doi.org/10.3928/01484834-20110517-05

Kirkman, T., (2013). The effectiveness of human patient simulation on nursing students' transfer of learning. *Clinincal Simulation in Nursing, 8* (8), e408. Retrieved from https://ac-els-cdn-com.bunchproxy.idm.oclc.org/S187613991200165X/1-s2.0-S187613991200165X-main.pdf?_tid=d02491c6-f0a6-11e7-9c2c-00000aab0f01&acdnat=1514998670_da5c7bdd065d70bda29ef0ed11f99b51

Koharchik, L., Weideman, Y. L., Walters, C. A., & Hardy, E. (2015). Evaluating nursing students' clinical performance. *American Journal of Nursing*, *115*(10), 64–67. http://doi.org/10.1097/01.NAJ.0000471947.66986.4a

Kolb, D. (1984). *Experiential learning.* Upper Saddle, NJ: Prentice Hall.

Lasater, K. (2007). Clinical judgment using simulation to create an assessment rubric. *Journal of Nursing Education 46*(11). 496-503. Retrieved from https://web-a-ebscohost-com.bunchproxy.idm.oclc.org/ehost/pdfviewer/pdfviewer?vid=1&sid=302b0e57-a2ca-4dff-b379-095699a7375f%40sessionmgr4008

Leach, J. (2014). Using simulation to expose shortcomings in clinical learning outcomes. *Nursing Education Perspectives*, *34*(6), 56–57. http://doi.org/10.1043/1536-5026-31.2.106

Lejonqvist, G., Eriksson, K., & Meretoja, R. (2016).Evaluating clinical competence during nursing education: A comprehensive integrative literature review. *International Journal of Nursing Practice, 22*(2), 142-151. doi: 10.1111/ijn.12406

Lejonqvist, G., Eriksson, K., & Meretoja, R. (2016). Evidence of clinical competence by simulation , a hermeneutical observational study. *Nurse Education Today*, *38*, 88–92. http://doi.org/10.1016/j.nedt.2015.12.011

Lewallen, L. P., & DeBrew, J. K. (2012). Successful and unsuccessful clinical nursing students. *Journal of Nursing Education*, *51*(7), 389–395. http://doi.org/10.3928/01484834-20120427-01

Lewis, R., Strachan, A., & Smith, M. M. (2012). Is high fidelity simulation the most effective method for the development of non-technical skills in nursing? A review of the current evidence. *The Open Nursing Journal*, *6*, 82–89. http://doi.org/10.2174/1874434601206010082

Lisko, S., & O'Dell, V. (2010). Integration of theory and practice: Experiential Learning Theory and nursing education. *Nursing Education Perspectives*, *31*(2), 106–108.

Lynn, M. C., & Twigg, R. D. (2011). A new approach to clinical remediation. *The Journal of Nursing Education*, *50*(3), 172–175. http://doi.org/10.3928/01484834-20101230-12

McCaughey, C. S., & Traynor, M. K. (2010). The role of simulation in nurse education. *Nurse Education Today*, *30*(8), 827–832. http://doi.org/10.1016/j.nedt.2010.03.005

Mee, C. L., & Schreiner, B. (2016). Remediation in nursing education today: Review of the literature and considerations for future research. *Journal of Nursing Regulation*, *7*(1), 37–45. http://doi.org/10.1016/S2155-8256(16)31040-7

National Council of State Boards of Nursing. (2011). *A preferred future for prelicensure nursing program approval: Part 1. Recommendations* [Fact sheet]. Retrieved from https:// www.ncsbn.org/Report_on_Future_of_Approval.pdf

Nehring, W., Ellis, W., & Lashley, F. (2001). Human patient simulators in nursing education: An overview. *Simulation and Gaming, 32*(2), 194-204. http://journals.sagepub.com/doi/abs/10.1177/104687810103200207

Oermann, M., Yarbrough, S., Saewert, K., Ard, N. & Charasika, M. (2009). Clinical evaluation practices in schools of nursing: National survey findings part II. *Nursing Education Perspectives, 30* (6), 352-357. Retrieved from https://journals.lww.com/neponline/Abstract/2009/11000/Clinical_Evaluation_And_Grading_Practices_in.4.aspx

Parsons, M. E., Hawkins, K. S., Hercinger, M., Todd, M., Manz, J. A., & Fang, X. (2012). Improvement in scoring consistency for the Creighton Simulation Evaluation Instrument©. *Clinical Simulation in Nursing*, *8*(6), e233–e238. http://doi.org/10.1016/j.ecns.2012.02.008

Patterson, M. D., & Geis, G. L. (2013). On the move : Simulation to performance. *Clinical Pediatric Emergency Medicine*, *14*(3), 214–223. http://doi.org/10.1016/j.cpem.2013.08.002

Poore, J. A., Cullen, D. L., & Schaar, G. L. (2014). Simulation-based interprofessional education guided by Kolb's experiential learning theory. *Clinical Simulation in Nursing*, *10*(5), e241–e247. http://doi.org/10.1016/j.ecns.2014.01.004

Rhodes, M. & Curran, C. (2005). Use of the human patient simulator to teach clinical judgment skills in a baccaluareate nursing program. *Computers, Infromatics, Nursing, 23* (5), 256-262. doi: 10.1097/00024665-200509000-00010

Rizzolo, M.A., Kardong-Edgren, S., Oermann, M., Jeffries, P. (2015). The National League for Nursing project to explore the use of simulation for high-stakes assessment: Process, outcomes and recommendations. *Nursing Education Perspectives, 36*(5), 299-303. doi: 10.5480/15-1639

Rochlen, L., Housey, M., Gannon, I., Tait, A., Naughton, N., & Kheterpal, S. (2016). A survey of simulation utilization in anesthesiology residency programs in the United States. *A & A Case Reports, 6*(11), 335-342.

Sanfey, H., Williams, R., & Dunnington, G. (2013). Recognizing residents with a deficiency in operative performance as a step closer to effective remediation. *Journal of the American College of Surgeons*, *216*(1), 114–122. http://doi.org/10.1016/j.jamcollsurg.2012.09.008

Stirling, K., Hogg, G., Ker, J., Anderson, F., Hanslip, J., & Byrne, D. (2012). Using simulation to support doctors in difficulty. *Clinical Teacher*, *9*(5), 285–289. http://doi.org/10.1111/j.1743-498X.2012.00541.x

Sullivan-Mann, J., Perron, C. & Fellner, A. (2009). The effects of simulation on nursing students' critical thinking scores: A quantitative study. *Newborn and Infant Nursing Reviews, 9* (2), 111-116. doi: 10.1053/j.nainr.2009.03.006

Todd, M., Manz, J. A., Hawkins, K. S., Parsons, M. E. & Hercinger, M. (2008). The development of a quantitative evaluation tool for simulations in nursing education. *International Journal of Nursing Education Scholarship*, *5*(1), 1-17. Retrieved from http://www.bepress.com/ijnes/vol5/iss1/art41

Weaver, A. (2011). High-fidelity patient simulation in nursing education:An integrative review. *Nursing Education Perspectives, 32*(1), 37-40. doi: 10.5480/1536-5026-32.1.37

Williamson, K., Quattromani, E., & Aldeen, A. (2016). The problem resident behavior guide: Strategies for remediation. *Internal and Emergency Medicine*, *11*(3), 437–449. http://doi.org/10.1007/s11739-015-1367-5

Wolfgram, L. J. B., & Quinn, A. O. L. (2012). Integrating simulation innovatively: Evidence in teaching in nursing education. *Clinical Simulation in Nursing*, *8*(5), e169–e175. http://doi.org/10.1016/j.ecns.2010.09.002

Appendix A

Figure A1 Kolb's Experiential Learning Theory

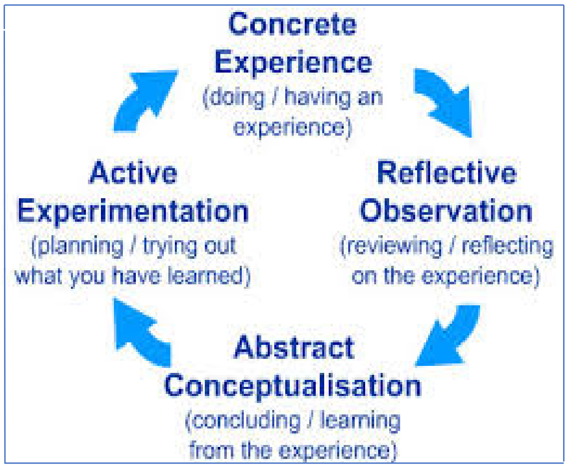
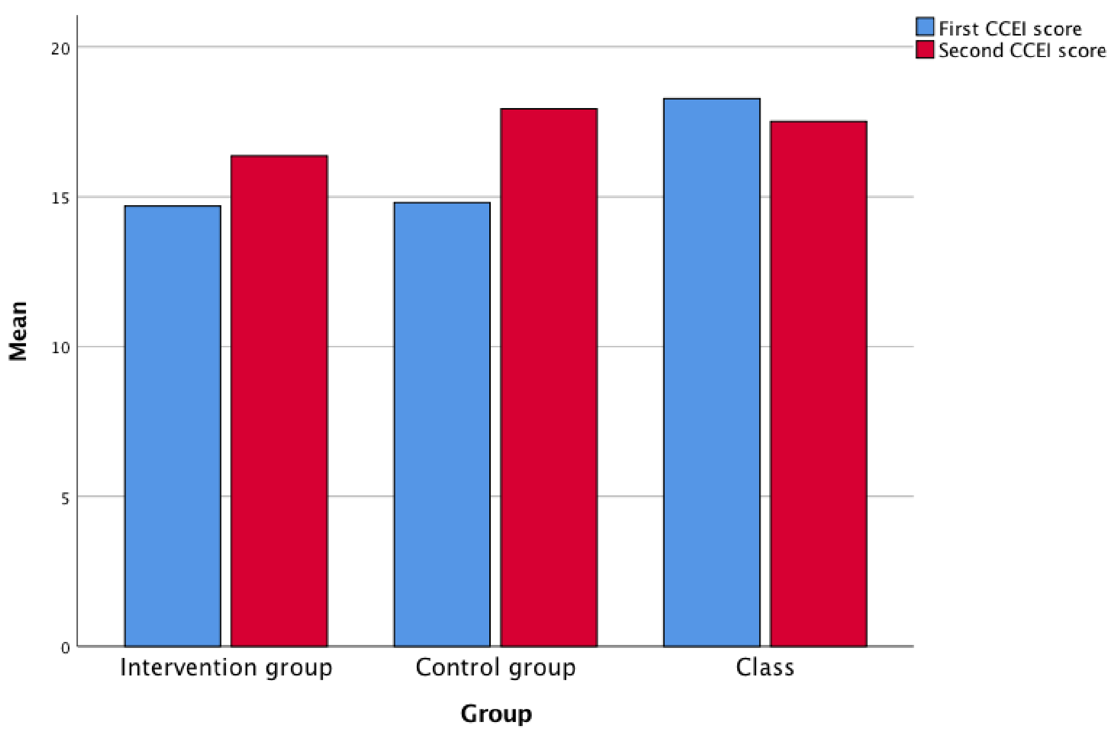


Figure 1. Model of Kolb's Experiential Learning Theory. Adapted from: McLeod, S. (2010). Kolb Learning Styles. *Simply Psychology.* Retrieved from: http://www.simplypsychology.org/learning-kolb.html

Figure A2 Mean CCEI Pre and Post-Scores by Group



Appendix B

Table B1

Sample descriptive statistics

Demographics	Class	Intervention	Control	Sig.
n	76(100)	18 (23.68)	15 (19.74)	
Age	20.82(1.44)	21.06(1.35)	20.27(.594)	F(1,30) = 4.40; p=0.04
Gender				$\chi^2(1) = 0.599$; p=0.579
Male	7(9.2)	1(5.6)	2(13.3)	
Female	67 (88.2)	17(94.4)	13(86.7)	
Prior Degree				$\chi^2(1) = 1.77$; p=0.489
None	71(93.4)	16(88.9)	15(100)	
Associates	2(2.6)	2(11.1)		
Bachelors	1(1.3)			
Course of Study				$\chi^2(3) = 2.75$; p=0.432
Belmont	44(57.9)	11(61.1)	11(73.3)	
Transfer	10(13.2)	3(16.7)	0(0)	
Partner	12(15.8)	3(16.7)	3(16.7)	
Fast Track	8(10.5)	1(5.6)	1(6.7)	

Table B2

Independent t test for pre-scores and post-scores by group

	Post			Pre						
	M	SD	n	M	SD	n	t	df	p	95% CI
Intervention	16.78	3.00	18	14.61	.98	18	-.431	31	.669	-1.082, 0.705
Control	17.93	2.6	15	14.80	1.52	15	-1.169	31	.252	-3.172, 0.862

Table B3

Independent t test for pre-scores and post-scores by group

	Diff		Post			Pre						
	M	SE	M	SD	n	M	SD	n	t	df	p	95% CI
Intervention	2.17	3.35	16.78	3.00	18	14.61	.98	18	2.75	17	.014	3.83, 0.50
Control	3.13	3.34	17.93	2.60	15	14.80	1.52	15	3.64	14	.003	4.98, 1.29
Class	-.77	2.37	17.51	2.53	43	18.28	1.26	43	-2.12	42	.040	-.04, -1.50