

# Collaborative Testing: An Effective Invitational Strategy for High-Stakes Testing in Nursing

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## ABSTRACT

**Background:** A collaborative testing intervention was designed as an application of the invitational education model in an undergraduate nursing course. The purpose of this study was to evaluate the effect of collaborative testing on examination scores and knowledge retention of course content and to evaluate students' feelings about the collaborative testing process. **Method:** A quasi-experimental design was used to evaluate the effect of collaborative testing on examination scores and knowledge retention among undergraduate nursing students in a public health course ( $N = 106$ ). A descriptive survey was used to evaluate students' perceptions of the collaborative testing intervention. **Results:** Collaborative testing increased examination scores and facilitated knowledge retention. Students' perceptions of the intervention were positive. **Conclusion:** Invitational strategies, such as collaborative testing, may result in measurably better outcomes, such as better examination scores and improved knowledge retention. Rigor does not need to be a barrier to invitational learning and, in fact, it may be complemented and enhanced by it. [*J Nurs Educ.* 2018;57(5):291-295.]

The Bachelor of Science in Nursing (BSN) program at this 4-year public college was conceptualized and designed as a practical model within the context of invitational education theory (Grason & White, 2013) as applied to nursing education (Worthey, 2014). The basic assumptions of invitational education theory are: (a) individuals are able, valuable, and responsible, and should be treated accordingly; (b) helping is a cooperative, collaborative alliance in which the process is as important as product; (c) individuals possess relatively untapped potential in all areas of human development; and (d) human potential can best be realized by places, policies, programs, and processes that are intentionally designed to invite development, and by individuals who consistently seek to realize this potential in themselves and others, personally and professionally (International Alliance for Invitational Education, n.d.; Purkey & Novak, 1996).

Invitational education theory has not been widely applied in nursing education. Incorporating invitational principles, Ripley (1986) measured associate level (Associate of Science in Nursing [ASN]) student perceptions of educator's behaviors within a clinical teaching survey. Finger and Pape (2002) examined student perceptions of invitational behaviors during a perioperative preceptorship. Incorporating the clinical teaching survey and self-evaluation questionnaire, Cook (2005) examined BSN student anxiety levels and invitational teaching behaviors. A more recent study utilized an invitational approach to examine lesbian, gay, bisexual, transgender access to supportive care and recommended that invitational approaches be used in health professions education (MacDonnell, 2014).

In order to become licensed as RNs, graduates of nursing programs must successfully pass the NCLEX-RN. Despite controversy about the use of high-stakes testing, especially for programs with a highly diverse student body (Petersen, 2005), the majority of nursing programs incorporate high-stakes NCLEX-style testing into programs of study (Coons, 2014). The National League for Nursing (2012) has created guidelines for the fair use of high-stakes testing that acknowledge the need for robust measures to evaluate competence, support student learning, and improve program outcomes within a context of equity and balance. We identified collaborative testing as a method that might help create an intentionally invitational testing environment and support development of collaboration skills, while preserving the robust nature of NCLEX-style course testing.

Collaboration, defined as the "process of joint decision making among independent parties involving joint ownership of

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decisions and collective responsibility for outcomes” (Liedtka & Whitten, 1998, p. 186), is also an essential competency of professional nursing (Cronenwett et al., 2007; Institute of Medicine, 2001, 2010). Collaborative testing is a creative learning strategy designed to elicit student teamwork and enhance content understanding (Cortright, Collins, Rodenbaugh, & DiCarlo, 2003; Gilley & Clarkston, 2014; Leight, Saunders, Calkins, & Withers, 2012).

In addition to investigating the intervention as a way to promote invitational education and to promote collaboration, we were interested in learning whether collaborative testing could affect students’ test scores and retention of information. In a comprehensive literature review of the use of collaborative testing in nursing, Sandahl (2009) found literature to support the use of collaborative testing across disciplines (Baumberger-Henry, 2005; Beeken, 1991; Duncan & Dick, 2000; Gokhale, 1995; Rao & DiCarlo, 2000), including health care disciplines. Sandahl (2009) concluded that although collaborative testing consistently increases test scores (Meinster & Rose, 1993; Nowak, Miller, & Washburn, 1996; Rao & DiCarlo, 2000), its effect on knowledge retention has not been established (Cortright et al., 2003; Griffin et al., 1995; Lambiotte et al., 1987; Lynch, 1984). This literature review also found that students perceived collaborative testing positively, resulting in less anxiety (Mitchell & Melton, 2003; Phillips, 1988; Zimbardo, Butler, & Wolfe, 2003), increased learning (Cortright et al., 2003; Durrant, Pierson, & Allen, 1985; Griffin et al., 1995; Mitchell & Melton, 2003; Nowak et al., 1996), improved student relations (Nowak et al., 1996), improved thinking skills (Griffin et al., 1995), and increased motivation (Zimbardo et al., 2003).

Sandahl (2009) identified nine studies that addressed collaborative testing in nursing education (Durrant et al., 1985; Gaskins & VanderMeer, 1992; Hickey, 2006; Hoke & Robbins, 2005; Lusk & Conklin, 2003; Mitchell & Melton, 2003; Phillips, 1988; Rossignol, 2004; Wink, 2004). Based on these, Sandahl (2009) concluded that although a paucity of evidence exists regarding the use of collaborative testing in nursing, it may be concluded that collaborative testing does increase examination scores in nursing education; this review did not find sufficient evidence regarding the effect of collaborative testing on retention of knowledge. Sandahl (2009) suggested that future research focus on retention.

A PubMed® and Google™ Scholar search revealed eight additional studies related to collaborative testing in nursing. Hanna, Roberts, and Hurley (2016) found that collaborative scores were higher than individual scores, but there was no significant difference between the standardized exit examination scores after the use of the collaborative testing intervention and the scores of students in previous semesters. Rivaz, Momennasab, and Shokrollahi (2015) found that a collaborative testing intervention improved both performance and retention in a medical-surgical nursing course. Qualitative studies found that students perceive the collaborative testing process positively (Duane & Satre, 2014; Peck, Werner, & Raleigh, 2013). Centrella-Nigro (2012) and Wiggs (2011) found that students perceive collaborative testing as improving critical thinking and retention of content and as reducing test-related anxiety. Wiggs (2011) also found that although collaborative testing improved examination

scores, it did not result in overall grade inflation. Wiggs (2011) also established that although grade inflation related to collaborative testing is frequently cited as a concern, there is evidence suggesting that collaborative testing does not result in grade inflation (Kapitanoff, 2009; Russo & Warren, 1999). Duane and Satre (2014) recommended specific strategies to control grade inflation. Molsbee (2013) found that for students who passed more than one class due to collaborative testing points, chances of success in the program were diminished, and recommended that collaborative testing be used to increase collaboration, not to add significant points to a grade. Martin, Friesen, and DePau (2014) found that collaborative testing resulted in higher test scores than traditional testing and that students perceived that they understood course material better after collaborative testing and improved their communication and negotiation skills. These authors recommended using a weighted strategy for credit to avoid grade inflation.

In this article, we describe the intervention of collaborative testing as application of the invitational education model in an undergraduate public health nursing course. The purpose of this quasi-experimental study was to answer the questions: (a) Does collaborative testing affect student performance on tests, and (b) Does collaborative testing affect student retention of course content. In addition, we sought to evaluate students’ feelings about the collaborative testing process.

## Method

The design of this study was both quasi-experimental and descriptive. It was approved by the college’s institutional review board. All students enrolled in public health nursing courses over the course of one year ( $N = 108$ ) were invited to participate in the study by (a) participating in collaborative testing, and (b) completing the survey questionnaire. Participation in the study was voluntary, and students could withdraw at any time. Participation in the study was not required to participate in the collaborative testing intervention as a course activity. Students could receive extra points on their individual test score, depending on the score on their collaborative test ( $A = 4$  points;  $B = 2$  points;  $C$  or lower = 0 points), but the extra credit was not tied to participation in the study. We also collected basic demographic data, including gender and age, at baseline for potential analysis as categorical variables. All but two students consented to participate in the study ( $N = 106$ ). The return rate for the surveys at the end of the semester was 90% (95 of 106). Nineteen percent of the participants were male, and 81% were female.

The nursing program administers all examinations in a dedicated testing center on campus, using the college’s online learning management system to facilitate student comfort and competence in an NCLEX-style environment. For the collaborative testing intervention, each student first took an individual examination for the unit examination on the assigned date, as described. Participating students could leave the testing room only for a brief solo restroom break with permission from the proctor and could not access any electronic or written materials, cell phones, personal contacts, or other resources between the initial examination and the collaborative examination. Total examination time for the individual examination was established by allowing 90 seconds per test item. This first individual ex-

amination result was blinded. Immediately following the initial examination, each student was given the option to retake the same examination collaboratively in a group of four to five students preassigned by course faculty.

Students were assigned to collaborative groups randomly, but with minor adjustments by course faculty to ensure that at least one strong reasoner or test-taker was in each group (based on scores from previous examinations). New groups were established by the same method for each unit examination. All students participating in the collaborative testing began the process at the same time and had 45 seconds per test item to complete the collaborative examination. During the collaborative process, groups were encouraged to discuss their rationales for answers and come to consensus about the correct answer. Timing for collaborative testing accommodated students with disabilities who had testing plans in place with the Office of Disability Services.

To determine whether students scored higher on a collaborative group examination than on the individual examination, we used a paired  $t$  test to compare the average of scores obtained when individual students completed an examination (original scores) with the average of scores obtained by individuals on the same examination in the collaborative group format (collaborative scores). Each student took three individual unit examinations, so the units of analyses were the averages of three unit examinations and three collaborative examinations for each student.

To evaluate retention, a subset of five items gleaned from unit examinations was retested at the end of the semester. The subset of items was chosen based on the following criteria: (a) the item had to have a 50% to 75% correct response rate on the individual examination, and (b) the item had to have a 100% correct response rate on the collaborative examination. To determine whether collaborative testing facilitated student retention of course content, we employed a paired  $t$  test to compare the number of items students answered correctly on the original subset of questions to the number of items they answered correctly on the final subset of questions. We defined retention as “the proportion of knowledge retained by an individual after a specific retention interval” (Bruno, Ongaro, & Fraser, 2007, p. 15). Therefore, we posited that retention would be demonstrated if a student correctly answered the same or more items on the final subset as on the original subset.

Finally, we used the Student Evaluation of Collaborative Testing 13-item survey (Leight et al., 2012) that was adapted from Cortwright et al. (2003), with 5-point Likert scales (1 = *completely disagree*; 2 = *disagree*; 3 = *neither agree nor disagree*; 4 = *agree*; 5 = *completely agree*) to evaluate the students’ feelings about the collaborative testing process. The students completed the evaluation at the end of the course. Results from the questionnaire were analyzed as ordinal data and reported as percentages of responses in each category. The survey questions addressed student understanding of and ease of the process of collaborative testing, group collaborative process, ability to recall information because of the process, and appeal of collaborative testing as strategy.

## Results

A paired-samples  $t$  test was conducted to compare individuals’ average examination scores before-and-after collaborative

testing. There was a significant difference in the scores before ( $M = 80.48$ ,  $SD = 4.58$ ) and scores after ( $M = 91.35$ ,  $SD = 1.93$ ) the collaborative testing intervention,  $t(105) = -26.32$ ,  $p \leq .001$ . These results suggest that the collaborative testing intervention improved examination scores. Specifically, our results suggest that when students collaborate as a group on an examination, their scores are higher than any individual examination score on the same examination.

Students retained information following the collaborative intervention. The number of items individual students answered correctly at the end of the semester on the final 5-item subset ( $M = 3.72$ ,  $SD = 3.89$ ) was the same or higher than the number of items answered correctly on the original five-item subset ( $M = 3.48$ ,  $SD = 7.52$ );  $t(-1.69)$ ,  $p = .0473$ . Therefore, students who participated in collaborative testing had retained the information at the end of the semester.

Finally, students liked the collaborative testing process. Greater than 90% of respondents either *agreed* or *strongly agreed* to all 13 items on the Student Evaluation of Collaborative Testing survey, indicating that students had a positive perception of the intervention, the process, and the group collaboration that occurred, perceived that the process enhanced concept understanding and knowledge, and reduced stress.

## Conclusion

We found that scores on collaborative examinations were significantly higher than scores on individual examinations. This finding is congruent with much of the existing literature (Hanna et al., 2016; Meinster & Rose, 1993; Nowak et al., 1996; Rao & DiCarlo, 2000; Rivaz et al., 2015; Sandahl, 2009; Wiggs, 2011). A question that might be posed about this finding is “so what?” That a group effort on an examination would be higher than an individual effort seems obvious. The real importance of this finding is that it demonstrates the value of collaboration—an essential professional competency in nursing—and supports the application of an invitational model in nursing education to promote students’ skill in collaboration. Students quickly recognize that a group effort yields better results because of individual knowledge and strengths and that they must also learn to support a rationale and reach a consensus answer when disagreement occurs. Our findings support the need for more research into the effect of collaborative testing on development of collaborative skills.

Like others (Cortright et al., 2003; Rivaz et al., 2015; Sandahl, 2009), we found that students retained knowledge from collaborative testing. This is an important finding simply because there is conflicting evidence (Griffin et al., 1995; Lambiotte et al., 1987; Leight et al., 2012; Lynch, 1984) about whether collaborative testing does or does not facilitate retention of knowledge. Our work adds to a growing body of evidence that collaborative testing does facilitate retention. Any intervention that may help students retain information is valuable; information retained is information that may be applied to future clinical reasoning. We recommend additional research to confirm these results and investigate how long information is retained following collaborative testing.

We identified several barriers to and facilitators of the collaborative testing intervention. Because of the time required



to implement a collaborative intervention following each unit examination, the number of items on each examination had to be limited. This constraint affected the usefulness of using high-stakes examinations as a tool to improve students' mastery of self-pacing and tolerance in high-item examinations. In addition, some students had disability accommodations that required up to double the time for examinations. In order for those students to participate in the collaborative intervention, at least 1 hour extra (and in some cases more) was allotted before the remainder of the class began testing. These time constraints were challenging and might not be feasible for many programs. At our institution, having a dedicated high-technology testing center and a flexible online learning management system for delivering examinations was essential to our ability to implement collaborative testing. Finally, as identified by other researchers (Martin et al., 2014; Molsbee, 2013), the potential for grade inflation may exist with collaborative testing. We designed the credit for collaborative testing to be less than a half letter grade; however, anecdotally, three students passed a public health course because of the collaborative testing points, who were later dismissed from the program for failure in subsequent courses. There is not enough evidence from this study or others to make a specific recommendation for practice related to controlling for grade inflation. We do recommend that further studies explore the relationship between collaborative testing, course pass rates, graduation rates, and NCLEX success. In addition, we are intrigued by the potential of exploring whether collaborative testing affects knowledge retention among non-native English speakers differently than it does among native English speakers. As we began data analysis, we recognized that this might be an important variable to explore, but we had not included it in our study design.

For our courses, the strengths of the intervention's design largely outweighed the limitations. Students' overwhelming enthusiasm for and positive perceptions of collaborative testing mirrored findings in the literature (Centrella-Nigro 2012; Duane & Satre, 2014; Durrant et al., 1985; Griffin et al., 1995; Martin et al., 2014; Mitchell & Melton, 2003; Nowak et al., 1996; Peck et al., 2013; Phillips, 1988; Wiggs, 2011; Zimbardo et al., 2003). Anecdotally, the feeling at the end of examinations was palpably different in courses that implemented collaborative testing. Students generally left the testing environment with a positive demeanor, smiles on their faces, and enthusiasm for the process. To gain a deeper, richer understanding of the collaborative testing experience, we recommend exploring faculty and student experiences, as well as perceived barriers to and facilitators of the process using qualitative methods. In addition, the vigor of student discussion during the collaborative process was notable. Negotiation and consensus building were evident in animated conversations and exchange of rationales. The request for one-to-one examination reviews with faculty was reduced because students had generally answered one another's questions and provided adequate rationales for their teammates by the time each collaborative examination was finished.

Invitational education emphasizes deliberative dialogue, positive interaction, and mutual respect among those involved in the educational process. Invitational programs promote ac-

tive and collaborative participation in all processes. As an intentionally invitational program, we seek to thread the tenets of the model throughout the curriculum and activities and see the invitational education model as a concrete way to model ideal professionalism to nursing students to build professional competence among them. When invitational strategies result in measurably better outcomes, such as better examination scores and improved knowledge retention, we demonstrate that rigor need not be a barrier to invitational learning and, in fact, may be complemented and enhanced by it.

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