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Featured Article

Online Simulation-Based Mastery Learning with Deliberate Practice: Developing Interprofessional Communication Skill

Vicky J.-H. Yeh, PhD, RN[a,*], Gwen Sherwood, PhD, RN[a], Carol F. Durham, EdD, RN[a], Suzie Kardong-Edgren, PhD, RN[c], Todd A. Schwartz, DrPH[a,b], Linda S. Beeber, PhD, PMHCNS-BC[a]

[a]*School of Nursing, The University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA*
[b]*Department of Biostatistics, Gillings School of Global Public Health, The University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA*
[c]*School of Nursing and Health Sciences, Robert Morris University, Moon Township, Pennsylvania, USA*

KEYWORDS
deliberate practice;
mastery learning;
online learning;
interprofessional communication;
nursing education;
SBAR;
critical incident reporting

Abstract

Background: New nursing graduates rarely achieve practice-ready competency in reporting critical information to other health care professionals.

Methods: This experimental group comparison study used an online asynchronized simulation intervention based on deliberate practice incorporated with mastery learning to explore the impacts on students' critical incident reporting skill.

Results: The intervention group (n = 22) demonstrated higher performance and confidence levels than the control group (n = 21), although few participants achieved mastery standard, indicating more practice and/or a longer learning period was needed.

Conclusion: The online intervention offered flexible and safe opportunities for students to practice a skill with limited real-life practice opportunities.

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Ineffective interprofessional communication is a major factor in health care errors (CRICO, 2015; The Joint Commission, 2017). An integrated review of 22 studies on nurse-physician communication concluded that factors such as having different communication styles, few opportunities to practice communication, and lack of mutual understanding of roles and responsibilities can contribute to

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* Corresponding author: vickyyeh@alumni.unc.edu (V. J. -H. Yeh).

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dissatisfaction with ineffective interprofessional communication and potential treatment delays (Tan, Zhou, & Kelly, 2017). Yet, crowded prelicensure curricula leave insufficient time, resources, assessment tools, and feedback mechanisms to prepare new graduates entering the work force with effective interprofessional communication skills (Guhde, 2014). Although standardized communication tools such as SBAR (situation, background, assessment, recommendation) (Institute for Healthcare Improvement, 2017) are taught in nursing schools to facilitate communication among professions, without practice, students are unlikely to be able to apply these tools under pressure in clinical situations. Increasing evidence demonstrates that learning clinical skills by practicing (i.e., experiential learning) is an effective educational pedagogy that could lead to positive student learning outcomes (Hill, 2017; Koponen, Pyörälä, & Isotalus, 2012; Meehan & Menniti, 2014).

Key Points

- Prelicensure nursing students have limited opportunity to practice interprofessional critical incident–reporting skill which can impact patient safety.
- Asynchronized online simulation-based deliberate practice provides flexible opportunities for students to practice SBAR reporting and receive feedback in a safe learning environment.
- Regular engagement in online deliberate practice can have a positive impact on students' SBAR report performance and self-confidence. Further study can help determine the practice time needed to reach mastery and long-term skill retention.

Both the Quality and Safety Education for Nurses (QSEN) project and the Interprofessional Education Collaborative (IPEC) have outlined competency-based educational goals for interprofessional communication (Cronenwett et al., 2007; Interprofessional Education Collaborative Expert Panel, 2011). An integrative review on interprofessional communication indicated that the use of simulation and standardized communication tools could effectively improve interprofessional communication skills (Foronda, MacWilliams, & McArthur, 2016). The review further recommends online or virtual simulation as a strategic future direction of interprofessional communication training (Foronda et al., 2016). Asynchronous online simulation, which provides experiential learning opportunities without the restraints of facility scheduling and faculty time, presents such an education modality.

The purpose of this study was to test the conceptual model of deliberate practice (DP) (Ericsson, Krampe, & Tesch-Romer, 1993) within the theoretical framework of mastery learning in providing online simulation-based opportunities for prelicensure nursing students to practice reporting patient critical incidents. The potential impacts of this educational intervention on learners' outcomes were explored in a pilot experimental study. This manuscript follows the Reporting Mastery Education Research in Medicine (ReMERM) Guidelines (Cohen et al., 2015).

Theoretical Framework

Deliberate Practice

Ericsson et al. (1993) first identified the role of DP in working with expert performers in music, sports, and chess where purposeful, repetitive, and extended practice with feedback from a teacher (i.e., DP) improved motivated learners' performance and helped mitigate skill growth stagnation. DP relies on a motivated individual's repetitive engagement in a cycle of (a) practicing with a well-defined goal, (b) receiving immediate feedback, (c) self-reflecting on performance to reset practice goals, and (d) repeating practice with an effort to achieve the revised goals (Ericsson et al., 1993; Ericsson, 2008). The concept has further been applied for development of both technical and nontechnical skills in medical education (McGaghie, Issenberg, Cohen, Barsuk, & Wayne, 2011). DP provides a model to structure effective practice, particularly when complemented by the theoretical framework of mastery learning to help guide learners with different baseline skill aptitudes, and learning needs to meet the desired outcomes.

Mastery Learning

Mastery learning is an outcome-based educational model where educators preset a mastery standard that all learners are to achieve before they can advance to the next unit/level. This mastery standard is referred to as the ''minimum passing standard'' (MPS) (McGaghie et al., 2009). The instructor must consider differences in the learners' learning needs and provide the resources and time necessary for all students to achieve a predefined learning outcome (Block, 1971).

Mastery learning is important in health professions education because the learners' learning outcomes directly impact the care they provide to patients. McGaghie et al. (2009) identified seven essential features of mastery learning: (a) measure baseline performance, (b) have clear learning objectives, (c) engage in learning activities, (d) preset an MPS, (e) assess the learning outcome(s), (f) advance to the next learning unit, and (g) continue practice until reaching the final mastery level. This study intertwined the theoretical framework of mastery learning with DP by focusing on a learning unit, that is, mastery of communicating pertinent patient information in an SBAR report as measured by a checklist as the primary outcome measure. Although beyond the scope of the present study, the intent is that students move to the next learning unit after meeting the MPS.

The purpose of this study was to test this education model by comparing the impact of engaging in online DP every other week for 10 weeks with impact of engaging in the same online learning module twice in the 10-week period on (a) prelicensure nursing students' ability to reach the MPS and (b) the changes in students' performance and confidence levels in reporting a patient critical incident. The goal was to improve communication skill by helping prelicensure nursing students meet a preset MPS in reporting a patient critical incident to another health care provider. The core elements of SBAR were used to set the MPS. The educational intervention included a series of asynchronous online simulation-based DP sessions designed to provide students with structured and focused practice opportunities. We hypothesized that the intervention will have a positive impact on nursing students' ability to meet the MPS and on their performance and confidence levels in reporting a patient critical incident.

Methods

Study Design and Data Collection

The study was designed as a pilot, experimental, pre—post test group comparison study conducted in the school of nursing in a public research university located in the Southeastern United States. Stratification by course section and block strategies were used to randomize the study participants (Figure 1). Following institutional review board exemption, the study ran for the 10 weeks of the summer term.

Participants and Recruitment

Participants were recruited from a cohort of 81 third-year prelicensure nursing students enrolled in a 10-week online summer course. The course had two identical but independent sections led by different faculty members. The first author introduced the study during the course orientation followed by an email invitation to students with a link to an electronic study consent form and a short demographic survey. Students were informed that participation in the study was confidential with no effect on their grade.

Intervention: Asynchronous Online Deliberate Practice Sessions

To simulate real-world clinical practice, professionally recorded audio stories produced by StoryCare®, Eefform, LLC, were used with permission to illustrate details of clinical scenarios. Nine stories were selected to form the basis for nine stand-alone online DP sessions. These stories were narrated with dialogs and thought processes from multiple perspectives (e.g., patient, nurse, physician) and included background sound effects (e.g., monitor beeps). Supplemental fictional patient information, such as the patient's vital signs, was provided in a chart-like format online.

Detailed description of the development and testing of the online DP sessions are reported in a separate article (Yeh, et al., 2019). In short, individual students were allotted 45 minutes to complete each asynchronous online DP session. During each session, students listened to a clinical story which necessitated reporting a patient critical

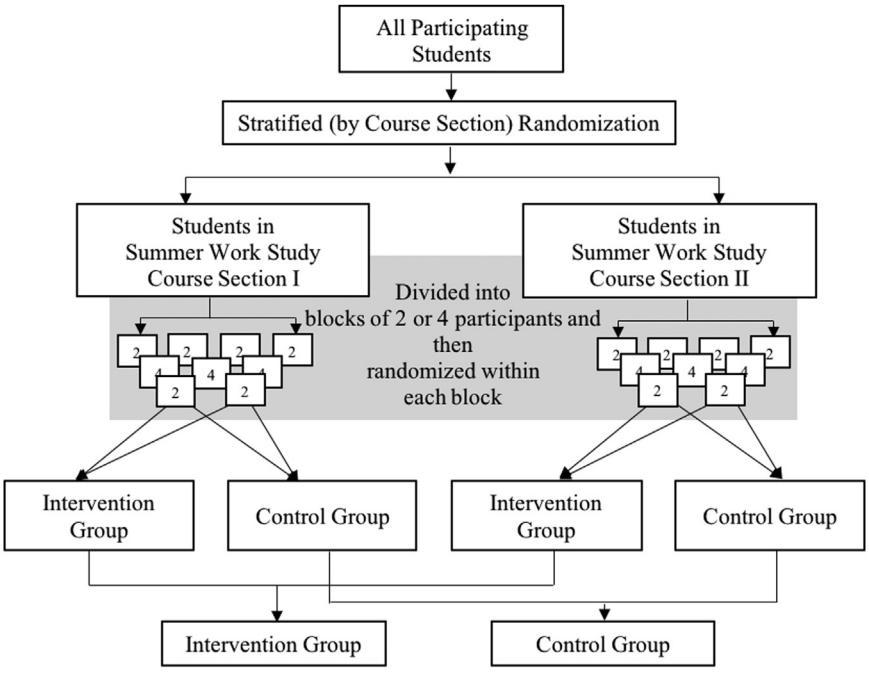

Figure 1 Stratified randomization by course section with the blocking feature.

incident to another provider in the steps illustrated in Figure 2.

Students enrolled in the course were required to complete two DP sessions as a nongraded part of the course; one session was at the beginning of the 10-week summer term and one at the end. Only the performance data from students who consented to participate were reviewed and analyzed. Course faculty were blinded to which students participated in the study. Because data collection took place within the semester, participants who did not meet the MPS by the end of the course were encouraged but not required to complete additional practice sessions. All students in the course were provided access to the nine online DP sessions after the study ended.

Comparison of Control and Intervention Groups

The results of the two course-required DP sessions served as the baseline assessment and posttest of participating students' performance. In addition to these two sessions, participants in the control and intervention groups were asked to complete additional assigned activities. Every other week, the control group participants completed a brief experience survey to report any real-life practice experience of reporting critical incidences to a provider; the intervention group participants completed one DP session and also reported any real-life practice experience. Students in the intervention group had access to four optional DP sessions for additional practice (Figure 3).

Incentives ($10) were provided to all participants for the assigned activities they completed. Students in both groups were encouraged to take advantage of any opportunity to practice the targeted skill in a clinical setting and document the experience. Participants who met the MPS received additional incentives ($20) at the end of the study.

Measurement

Assessment Tool

With permission, we developed story-specific checklists adapted from the identification, situation, background, assessment, recommendation (ISBAR) Interprofessional Communication Rubric (IICR) (Foronda et al., 2015) as the main assessment tool to measure students' SBAR report performance and determine whether the MPS was met. The ISBAR is an adapted version of the SBAR with "I" for "identification" (i.e., introduce self) which is part of "situation" in the standard SBAR report; therefore, the information to be reported using either of the tools is essentially the same. The IICR is a 5-category, 15-item rubric (scoring range: 0-15), with higher scores reflecting better performance. The original IICR had an interrater reliability (IRR) (r_s) of 0.79, with the content validity index of 0.92 (Foronda et al., 2015).

To standardize scoring among raters, the authors adapted the IICR checklists based on consultation with story-specific content experts (e.g., intensivist for stories in intensive care). The adapted ISBAR checklists included patient information specific to each story as subitems (Table 1). Raters checked "yes," "no," "incomplete," or "inaccurate" for each of the 15 items based on participants' responses. Three authors acted as independent raters to test the IRR of the adapted IICR checklists. Results indicated that the adapted IICR checklists had an acceptable IRR (either $\kappa > 0.41$ at the category level or $> 70\%$ overall percent agreement at the item level) (see Appendix A).

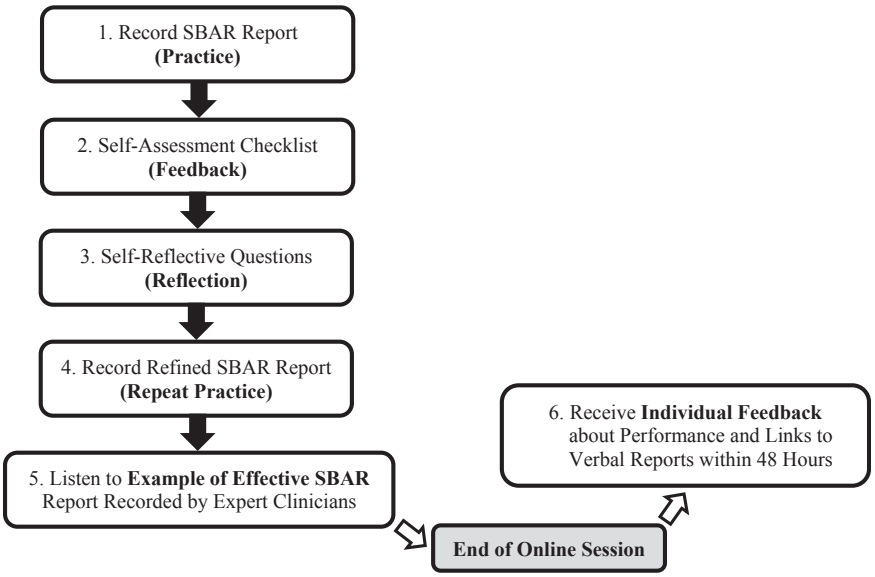

Figure 2 Steps of the online deliberate practice session. *Note.* SBAR, situation, background, assessment, recommendation.

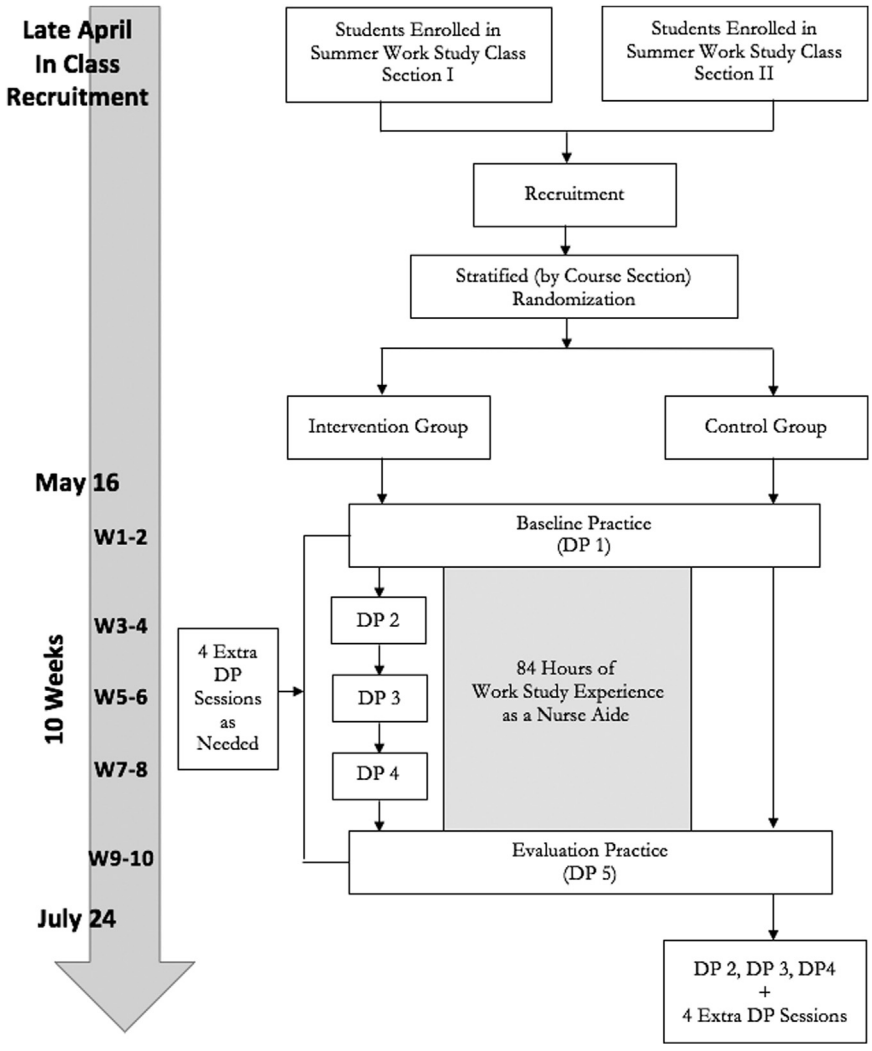

Figure 3 Study design. *Note.* DP, deliberate practice.

Performance

The adapted IICR checklists maintained the 5-category, 15-item, and 0-to-15 scoring range properties from the original IICR. The first author served as the primary rater and rated all the baseline and posttest reports made by the study participants. Two other raters (C.F.D. and G.S.) each rated 10% of these reports as a quality check. The audio files were randomly ordered and renamed by a statistician; therefore, all raters were blinded to the group to which students were assigned.

Mastery

Because the original IICR requires a learner to report at least two of the three items from each of the five ISBAR categories (Foronda et al., 2015), a learner can pass even though critical items are not reported, such as the name of the patient. To address this gap, we chose to use the full score of 15 on the adapted IICR checklists as the MPS. Still, we recognized students', yet limited, clinical knowledge and experience, so items scored as ''incomplete'' were converted to 'yes' (e.g., reported two out of four of the relevant assessment data) and items scored as ''inaccurate'' were converted to 'no' (e.g., inaccurate patient name) in determining if the MPS was met.

Confidence

On a scale of 0 (not at all confident) to 10 (extremely confident), participants rated their level of confidence in reporting a patient critical incident to a physician or nurse practitioner at the beginning and at the end of the study. Table 2 lists variables and covariates included in the study as well as how and when these variables were measured.

Sample Size and Power

With no preceding data, the median score (10.8, IQR = 3.6) of 74 BSN students calling a physician using ISBAR during a simulated experience (Foronda et al., 2015) was

Table 1 Categories and Items From the Original ISBAR Interprofessional Communication Rubric (IICR) and Examples of the Subitems Included in the Adapted IICR Checklists Used in This Study

Category	Original IICR Items	Adapted IICR Checklist Subitems
Identification	- Name	☐ John Doe
	- Position	☐ RN
	- Where he/she is calling from	☐ Neurology floor
		☐ Patient room number
Situation	- Patient by name and age	☐ Jane Smith
		☐ Age 83
	- Diagnosis or chief complaint	☐ General weakness
	- Reason for the call/problem	☐ Unusual bruises were found on patient while bathing
Background	- Admission date	☐ "About two months ago"
	- Relevant past medical history	☐ Is on warfarin (Coumadin)
	- Recent interventions for the patient	☐ Just returned home from children's home for dinner
Assessment	- Vital signs	☐ T: 36.5, P: 68, R: 14, BP: 106/88
	- Level of consciousness/behavior	☐ Alert and oriented to person, place, but not time which is baseline for the patient
		☐ Patient was smiling and in a good mood upon returning
	- Relevant assessment data	☐ Color of bruises
		☐ Location of bruises
		☐ Reported no pain
		☐ Last INR
Recommendation	- Suggests potential reason for condition or suggests intervention	☐ Suggest potential reason (e.g., falls, abuse) or intervention (e.g., request patient to be assessed)
	- Explains urgency of actions	☐ State the urgency or give a timeframe for action
	- Repeats back all orders; clarifying if needed	☐ Repeat back provider response

The categories and items of the original IICR were developed by Foronda et al. (2015). A mixed-methods, international, multisite study to develop and validate a measure of nurse-to-physician communication in simulation. *Nursing Education Perspectives*, *36*(6), 383 to 388. https://doi.org/10.5480/15-1644.
Note. ISBAR = identification, situation, background, assessment, recommendation.

conservatively used as the control group's mean score in calculating the power using nQuery Advisor® 7.0 (Statistical Solutions Ltd., Cork, Ireland). With n = 35 students in each of the control and intervention group, if the mean difference between two groups is 2 (standard deviation [SD] = 3), the statistical power would be 78%. Owing to a lower recruitment rate and data loss, this study was not well-powered to draw statistically significant conclusions for smaller effect sizes. However, the purpose of this study was to examine the feasibility of using an online DP intervention in an academic program and the impact of this intervention on participants' communication skills. The results could inform future studies with larger sample sizes that are powered to draw more robust conclusions on the efficacy of the intervention.

Statistical Methods

Descriptive statistics were used to describe the data collected, and Fisher's exact test was used to test the association between the group assignment and whether the MPS was met. Analysis of covariance (ANCOVA) was used to examine any group differences in the mean change in students' performance and confidence levels, controlling for covariates that might influence participants' learning outcomes (Table 2). Within the intervention group, Pearson correlational and linear regression analyses were used to explore the relationships between number of DP sessions completed and the participants' performance level change.

All statistical analyses were conducted using SAS® software, version 9.4 (SAS Institute, Inc., Cary, NC). A p value less than .05 was used to define statistical significance in this study.

Results

Participant Demographics

Of the 43 students (participation rate: 53.1%) consenting to participate in the study, 81.4% were female, the mean age was 23.1 years (SD: 4.7; range: 19-43), and 76.7% were pursuing their first bachelor's degree. Most had not worked in health care (67.4%), were white (79.1%), and were native English speakers (93.0%). Table 3 presents the participants' demographics by group.

Online Deliberate Practice Session Completion

All 43 participants completed the two course-required online DP sessions; however, five intervention group participants did not complete all three assigned additional

Table 2 Summary of Variables, Measures, and Time Points

Variable	Measurement	Time 1	Time 2	Time 3	Time 4	Time 5	Time 6
Mastery	Adapted IICR checklist	x				x	
Performance†	Adapted IICR checklist	x				x	
Confidence (self-reported)†	Numerical scale	x				x	
Experience: communication							
Familiarity with SBAR*	Baseline survey	x					
Practice outside of study*	Experience survey	x	x	x	x	x	
Experience: online course	Experience survey						x
Satisfaction	Evaluation survey						x
Demographics							
Age*		x					x
Gender*		x					x
English as a second language		x					
Work history in health care*		x					x
Course section*		x					x
Degree type*		x					x
Other:							
No. of DP sessions completed*						x	

Time 1 = Weeks 1 to 2 (baseline/pre-test); Time 2 = Weeks 3 to 4; Time 3 = Weeks 5 to 6; Time 4 = Weeks 7 to 8; Time 5 = Weeks 9 to 10 (post-test); Time 6 = Week 16.
The "x" represents time of measurement or data collection.
Note. DP = deliberate practice; IICR = ISBAR Interprofessional Communication Rubric; ISBAR = identification, situation, background, assessment, recommendation; SBAR = situation, background, assessment, recommendation.
* Covariates.
† Baseline score that is also used as a covariate.

online DP sessions, and four participants completed more than the five required DP sessions. The mean number of DP sessions completed by the intervention group was 4.9 sessions (SD: 1.5; median: 5.0).

Outcome Measurement

Mastery

Excluding missing data, posttest results from 20 participants of each group were available to assess whether students met the MPS. The observations excluded from the analysis were due to technical issues (e.g., verbal reports not saved). Fisher's exact test results showed that the association between the group and meeting the MPS was not significant (5% vs. 0%, $p = .49$).

Among all participants, only two from the intervention group reached the MPS of 15/15 on the adapted posttest IICR checklist. Participant A had a baseline performance score slightly above average (12/15 versus mean: 11.2; range: 6-14) while participant B's baseline performance score was missing

Table 3 Participant Demographics by Group

Variable	Control (n = 21)	Intervention (n = 22)	Total (*N* = 43)
Age (y)			
Mean (SD)	23.8 (5.4)	22.6 (4.1)	23.1 (4.7)
Median	22	21	21
Range	19-43	20-36	19-43
Course section 2	14 (66.7%)	14 (63.6%)	28 (65.1%)
Female	16 (76.2%)	19 (86.4%)	35 (81.4%)
Program: TBSN	19 (90.5%)	22 (100.0%)	41 (95.3%)
Second degree	9 (42.9%)	1 (4.5%)	10 (23.3%)
Have worked in health care	11 (52.4%)	3 (16.6%)	14 (32.6%)
English as a second language	19 (90.5%)	21 (95.5%)	40 (93.0%)
Familiarity with SBAR			
Have used	12 (57.1%)	11 (50.0%)	23 (53.5%)
Have heard of but not used	9 (42.9%)	11 (50.0%)	20 (46.5%)

Note. SBAR = situation, background, assessment, recommendation; SD = standard deviation; TBSN = Traditional Bachelor of Science in Nursing.

Table 4 Analysis of Covariance of Mean Performance and Confidence Level Change Between Groups

		Performance		Confidence	
Sample size		C: n = 20; I: n = 16		C: n = 20; I: n = 21	
t-test		Mean Difference (I − C)	*p* Value	Mean Difference (I − C)	*p* Value
		0.93	.1412	1.28	.0871
		SE = 0.61		SE = 0.73	
		I = 1.63, C = 0.70		I = 3.38, C = 2.10	
Base model: ANCOVA controlling for (a) course section, (b) baseline performance/confidence		Adjusted Mean Difference (I − C)	*p* Value	Adjusted Mean Difference (I − C)	*p* Value
		1.03	.0112*	0.95	.0228*
		SE = 0.38		SE = 0.40	
Base model: adding exploratory covariates one at a time as well as jointly	Age	0.98	.0197*	0.96	.0239*
		SE = 0.40		SE = 0.41	
	Outside practice	1.05	.0135*	1.21	.0042*
		SE = 0.40		SE = 0.39	
	SBAR familiarity	1.03	.0122*	0.98	.0176*
		SE = 0.39		SE = 0.39	
	Age, outside practice, and SBAR familiarity	1.01	.0253*	1.23	.0043*
		SE = 0.43		SE = 0.40	

Note. ANCOVA = analysis of covariance; C = control; I = intervention; SBAR = situation, background, assessment, recommendation; SE = standard error.
* $p < .05$.

because of technical issues. Participant A had a higher baseline confidence level than participant B (i.e., "fairly confident" versus "not at all confident" to "little confidence"). Overall, the 43 participants reported average baseline confidence as between "little confidence" and "somewhat confident" (mean = 4.9 on a scale of 1-10; SD = 2.4).

Change in Performance Level

Twenty baseline and posttest report pairs from the control group and 16 report pairs from the intervention group were used to compare participants' mean change in performance between groups. The *t*-test indicated no significance (mean difference: 0.93; standard error [SE] = 0.61; $p = .14$). After controlling for "course section" and "baseline performance" as the main covariates using ANCOVA (the base model), the mean performance change at $p = .01$ (adjusted mean difference = 1.03; SE: 0.38; 95% confidence interval: 0.25-1.81) was significant, meaning the intervention group participants showed greater performance improvement than the control group.

Change in Confidence Level

Paired (baseline and post-test) confidence levels of 20 control group participants and 21 intervention group participants were included in the ANCOVA. Although the *t*-test results were not significant (mean difference: 1.28; SE: 0.73; *p* value = .09), the ANCOVA results showed that, after controlling for the covariates of "course section" and "baseline confidence" (base model), a significant group difference ($p = .02$) was evident in the participants' change in mean confidence level (adjusted mean difference = 0.95; SE: 0.40; 95% confidence interval: 0.14-1.76).

Exploratory Within-Intervention Group Analysis

Owing to the small number of participants who met the MPS at the end of the study (n = 2; 9.1%), Pearson correlational and linear regression analyses were conducted to explore the relationship between the number of DP sessions that participants completed and their change in performance and confidence levels. Although marginally significant ($p = .09$ and $p = .07$, respectively), the number of DP sessions that the participants completed had (a) a negative relationship ($r = -0.44$) with their change in performance level and (b) a positive relationship ($r = 0.40$) with their change in confidence level. After controlling for the main covariates of "course section," "baseline performance or confidence level," and "the number of practices participants did outside the study," multiple linear regression revealed the relationships remained nonsignificant. Linear regression to examine the relationship between the intervention group participants' change in performance level and their change in confidence level over time indicated a negative ($r = -0.37$, $p = .15$) relationship between the two variables.

Participant Satisfaction and Intervention Evaluation

Of the 81 students enrolled in the online summer course, 46 (56.8%) completed an online evaluation survey (Appendix B). Participants included 18 students from the control group (group 1), 14 students from the intervention group (group 2), and 14 students from the group that did not participate in the experimental study (group 3). Although students from group 1 and 3 completed the same two course-required online DP sessions, only students in group 1 and 2 (experimental study participants) received individual feedback about their verbal SBAR performance. Overall, the respondents were satisfied with their experience in completing the online DP sessions (54.4% ''very satisfied'' and 39.1% ''somewhat satisfied'') and recommended keeping the online DP sessions as course assignments (86.7%).

Perceived Practice Needs and Preferred Practice Frequency

Most of the participants (80.4%) responded they would need to complete at least three online DP sessions to feel comfortable giving a critical incident report to a nonnurse health care provider. More students in group 2 (64.3%) than in the other two groups (group 1: 27.8%; group 3: 28.6%) reported they needed at least five sessions to feel comfortable doing so. Most students in group 1 (64.7%) and 2 (78.6%) recommended monthly or every other week practice interval would be good, whereas 83.4% of the students in group 3 recommended once or twice a semester.

Discussion

The overall results support the feasibility and demonstrate positive impact of using an asynchronous online approach to provide DP opportunities for prelicensure nursing students to develop their patient critical incident–reporting skills. These results can help guide future practice, education, and research to better prepare nurses for practice.

Mastery

The results indicated that engaging in an online DP session every other week over 10 weeks might not be sufficient to enable most prelicensure nursing students to meet the MPS, noting only two of the intervention group participants met the MPS at posttest. Although providing additional time and resources when needed is pivotal in mastery learning, only four students in the intervention group completed any extra practice. Explanations may be due to (a) competing priorities, (b) lack of motivation to complete the extra sessions, and/or (c) did not know how to self-assess if additional practice was needed. Nevertheless, a recent study using simulation-based mastery learning with DP to facilitate twenty intensive care nurses in achieving a preset MPS for central venous line dressing change supports the use of simulation-based mastery learning with DP in nursing (Dahlen, Finch, & Lambton, 2019). It remains for further study to determine if completing additional DP sessions would enable more participants to reach the MPS.

Of the two students who met the MPS, participant A, who reported high confidence in the targeted skill at baseline, only completed four of the five required DP sessions, whereas participant B, who had very little confidence in the targeted skill at baseline, completed all nine sessions available. While this represents only two cases, the results align with the hypothesis that if learners are provided with resources (more or less) according to individual needs, despite the individual differences observed at the baseline, the MPS can be achieved.

Performance and Confidence

A statistically significant group difference was evident in the participants' changes in performance level and confidence level from baseline to posttest, thus supporting our hypothesis that online DP intervention would positively impact learning outcomes. This significance was observed only when the participants' course section and baseline performance or confidence level were controlled. Also, when a standardized measurement tool with a maximum score is used, having a high baseline score would constrain the observable improvement as reflected in the change in scores of that participant.

ANCOVA results presented in Table 4 indicated that additionally controlling for variables that might have impacted students' performance (e.g., age, the number of practices they completed outside of the study, and their familiarity with SBAR) did not impact changes in their performance and confidence levels. This supports Ericsson's belief that DP may be a more important factor than age and the amount of past experience in skills acquisition (Ericsson, 2008). The results reported in this manuscript conservatively kept students in the group to which they were randomized, regardless if they completed the intervention, that is, completing all five required online DP sessions, which might not be a true reflection of the impact of the intervention. Therefore, an additional ''intervention adherence'' analysis was conducted in which only participants who completed the intervention were kept in the intervention group. The results of this exploratory analysis (Appendix C) were statistically comparable to those of the original analysis (Table 4). A key question is determining whether the results are statistically significant, clinically significant, or both; nevertheless, from an educational standpoint, every upward change in a learner's performance level in communication and/or confidence level represents improvement on average and marks a step closer to achieving mastery.

Differences within the Intervention Group

In the within-intervention group analysis, the relationships between the number of online DP sessions that participants completed and their change in performance level and confidence level were not statistically significant. However, this outcome could have been affected by the minimal variation in the number of DP sessions that participants completed. The direction of the associations, however, implies that more practice did not correlate with greater improvement but was associated with greater confidence. Students' self-perceived confidence level might not be the best indicator of their actual performance. The relationship between confidence and performance remains inconclusive and often unrelated (Barnsley et al., 2004; Clanton et al., 2014; Mullan & Koth, 2010). This lack of positive relationship between self-reported confidence and actual performance can be found in both simulation learning (Liaw et al., 2012) as well as in clinical practice (Ludikhuize et al., 2012). An inverse relationship can even be found in particular with novice learners who do not yet have the metacognitive skill to accurately evaluate their own ability (Kruger & Dunning, 1999). While more practice is associated with higher confidence, we need more objective measures to determine the association with performance improvement. Completing an effective SBAR requires clinical judgment to determine the relevant patient information to include in the report. The performance of participants might have been influenced by the stories used and the level of clinical judgment required.

Intervention Evaluation

Participants viewed the online DP sessions as highly satisfactory and recommended that the sessions be included in future offerings of the targeted course. A high percentage of participants in the intervention group reported the need for at least five (the highest number given) online DP sessions to feel comfortable in performing the targeted skill. They also indicated the ideal practice interval would be every other week (the shortest interval given). As students recognized improvement from more practice sessions, they might also recognize that to acquire a particular skill, they may need more practice over shorter time intervals.

This study added to the few but growing studies testing mastery learning with DP to develop learners' communication skills in nursing. Studies that have incorporated DP with or without mastery learning to develop patient information—reporting skills in medicine also found an increase in the participants' confidence level (Pukenas et al., 2014), better skill performance compared to a control group (Heiman et al., 2012), and more complete coverage of the items listed on the assessment checklist at posttest (Pukenas et al., 2014; Sawatsky, Mikhael, Punatar, Nassar, & Agrwal, 2013). The present study is unique in that it provided students with regular and repetitive practice opportunities over a period of time, whereas most of the relevant studies used intensive workshops that spanned from a few hours to a few days. DP emphasizes the significance of repetitive practice over time for skills acquisition; research findings also show that spaced practices with adequate breaks in between practices are beneficial in retaining the skills learned (Doyle & Zakrajsek, 2013; Oermann, Kardong-Edgren, Odom-Maryon, & Roberts, 2014; Shibata et al., 2017).

Using clinical stories and requiring students to verbalize their reports helped simulate a realistic experience but in a safe environment. The asynchronous online practice opportunities overcame the structural and scheduling barriers of on-site practice sessions by offering an online alternative educational methodology which can help preserve scarce resources.

Study Limitations

This study had several limitations. The sample size of this study was limited to the size of a class in a single university. Technical difficulties prevented saving some students' data, compounding the small sample size. It may be that students who volunteered to be in the study may have had more interest in developing the targeted skill than those who did not volunteer, thus selection bias. However, motivated learners are a key component of DP; thus, self-selection might have served well to test the conceptual model of DP. Further testing is required to generalize results.

The study outcome measurement focused on the immediate posttest conducted at the end of the study period. However, there was no provision for testing how well learning was retained over time, thus examining skill decay or how it would be transferred into clinical practice.

It also became apparent that an effective and informative SBAR report is more than merely stating factual information. The order of the information reported, the clinical relevancy of the content, and the length of the report are critical. The adapted IICR checklists provided a standard for scoring, yet a report could become lengthy and/or not ordered according to the sequence of SBAR and still receive a high score even if the report was not effective. Therefore, further development of the assessment tool is needed.

Conclusions

This study investigated an innovative online DP approach to provide simulated opportunities for health profession learners to develop interprofessional communication skills. The high participant satisfaction level and the positive impacts on the changes in learners' performance level and confidence level suggest the feasibility of the online DP

intervention and its applicability to educational programs. Implementing online DP intervention could help strained resources address learners' needs and provide an empowering experience for learners to boost their confidence and performance levels in critical skills that are difficult to practice in real life. Evidence-based teaching applications are needed to better prepare new graduates for transition into practice to provide improved, safe patient care.

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Supplementary Data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ecns.2019.04.005.

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