Evaluation of a Synchronous Online Innovation and Design-Thinking Module for Graduate Nursing Students

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Article

Abstract

Nursing innovation skills and knowledge are essential to advance and further nursing practice and the profession. Innovation requires fostering an innovator's mindset and human-centered design-thinking skills in nursing students. The 2021 AACN *Essentials* for graduate students include competencies related to innovation. An online Innovation and Design Thinking (I&DT) module, adapted from the National Science Foundation (NSF) I-Corps™ program, was developed as part of a required graduate nursing course in quality and safety. Students applied innovation skills to address stubborn nursing problems. Our pre-post single cohort study evaluated the online innovation module by measuring creative self-efficacy, psychological empowerment, and the traits of design thinking instruments in a sample of graduate students. Pre- and post-test surveys were matched; post-survey results confirmed significant increases in creative self-efficacy, psychological empowerment, and for the Traits of Design Thinkers instrument, the subscale Experimentalism showed a significant difference. Student innovations demonstrated their ability to innovate and prototype practical and clinical innovations, contributing to the safety, efficiency, and effectiveness of care. Findings confirmed, even with a small-matched pre-post sample (*n* = 45), that innovation skills can be developed using this synchronous online format and that confidence and interest in innovation skills was evident during the course. This method of including innovation content in graduate coursework can offer a valuable opportunity to demonstrate AACN innovation-related competencies.

Key Words: Nursing innovation, Design-Thinking, Human Centered Design, online learning, butAACN Competency, empowerment, creative self-efficacy, innovative capacity, NSF I-Corps Methods

Florence Nightingale may be considered the first nurse innovator to question serious and deadly hospital outcomes and subsequently develop a system to address the hygiene and hospital environment during her time. Nightingale founded professional nursing practice and designed the hospital wards most beneficial for healing soldiers in Crimea. She applied clinical and analytical skills and mathematical and statistical insights to significantly reduce deaths among soldiers and the population of London (Nightingale, 1859; Talsma et al., 2020). Recently, the National Academies of Medicine Report, *Future of Nursing 2020-2030: Charting a Path to Achieve Health Equity*, has documented the need to innovate the nursing profession to address current patient, family, and community needs and prepare technologies and approaches that support high-quality nursing practices (National Academies of Sciences, 2021)

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Despite its successful development and establishment as a professional practice, nursing must continue developing its practices and professional knowledge base. To meet current and future clinical and professional challenges, these gaps will need to be filled with research, evidence-based practices, and innovation in nursing practices. To address this need, a comprehensive education program must systematically support innovation by nursing students as a vital and valuable skill set to lead and advance patient outcomes and clinical practice.

Background

Nursing Innovation

Nursing innovations develop from research or originate from practice to resolve a clinical need or a broken process.

Nursing innovation entails finding new and better ways of addressing a practice or a system problem from an added-value perspective (Hagle et al., 2020). Nursing innovations develop from research or originate from practice to resolve a clinical need or a broken process. Innovations derived from nursing research commonly develop from funded preliminary studies followed by national and/or multi-site intervention studies and clinical trials demonstrating the impact of the developed innovations. Examples of practice-based innovations have included:

- The CAPABLE program, which aims to reduce disability for older adults (Szanton et al., 2021)
- The crash-cart, created in 1968 by Anita Dorr (Schriver et al., 2003)
- Neonatal phototherapy for jaundiced babies developed in the 1950s by Sister Jean Ward (Cosier, 2017)
- The Billi-bonnet (glasses for preemies) developed in the 1990s by Sharon Rogone (Dennis, 2012).
- In response to safety issues with intravenous (IV) lines, Teri Barton-Salinas developed color-coded IV lines (Cosier, 2017).

The COVID-19 pandemic led to numerous documented nursing innovations, notably related to patient management processes (Newby et al., 2020; Phillips et al., 2021).

Innovation in Graduate Education

Several American Association of Colleges of Nursing (AACN, 2021) *Essentials*-based competencies were specifically developed for graduate nursing programs. Examples of these competencies related to innovation include:

- 2.5k, Incorporate innovations into practice when evidence is not available,
- 2.5j, Examples of AACN *Essentials* Advanced Level competencies related to innovation include the Domain 2 Person-Centered Care sub-competency,
- 2.5k, incorporating innovations into practice when evidence is unavailable,
- Sub-competency 2.8g, including current and emerging technologies to support self-care management,
- Domain 4, Scholarship for the Nursing Discipline, includes sub-competency 4.2h to address opportunities for innovation and changes in practice.

Current nursing education programs provide limited training and guidance on the innovation process (White et al., 2016). Nursing programs typically do not prepare nurses to innovate their practices, and nurses lack the skills to develop and implement practice innovations. Though many universities have technology transfer and innovation support departments, few colleges of nursing have dedicated nursing innovation centers that focus on developing and training an innovation skillset (Barr et al., 2021). Innovation centers can provide necessary support and expertise in nursing innovations and serve as a valuable resource for faculty and students. Albert (2018) noted that, despite university and health system-level innovation centers, many nursing programs do not teach innovation skills, perhaps since nursing faculty are typically not prepared to facilitate such learning. Recognizing the contribution of nursing innovation to the profession, and the appreciation of learning these skills as nursing students, are essential steps toward validation of innovation education within academic and practice environments (Albert, 2018).

Current nursing education programs provide limited training and guidance on the innovation process.

Graduate nursing programs prepare students to lead and impact systems of care, safety, quality, and patient outcomes. Innovation within clinical practices, care models, and management strategies makes a powerful contribution to improved health and systems outcomes. As required by the AACN Competencies (2021), graduate nurses need exposure to innovative practices. A sample of these practices include the concepts of: Lean Launch (Blank, 2013); human-centered design (Melles et al., 2021); and design thinking (Brown & Watt, 2010) to recognize their innovative capacity to develop and lead innovations, and to demonstrate the AACN competencies (2021).

Innovation Training Program

Multiple approaches and strategies can support ideas to develop innovations. One approach was developed by the United States (US) National Science Foundation Innovation Corps (NSF I-Corps™) program is based on human-centered design/design thinking (HCD/DT) and Lean Launch. Launched in 2011, the NSF I-Corps aims to increase the economic impact of research and identify product or service opportunities emerging from academic research. The program was originally developed to maintain competitiveness in manufacturing and computer technology. Many inventors subsequently pursue NSF-based funding, such as a Small Business Innovation Research (SBIR) grant.

Multiple approaches and strategies can support ideas to develop innovations.

The NSF I-Corps program uses the customer discovery process to help academic research teams quickly assess the market potential of their discovery. This experiential learning program allows academics and students to discover potential stakeholders impacted by their idea and test hypotheses related to value propositions (i.e., pains or gains) for each stakeholder group (e.g., patients, payers, providers). For further information, see the *Program Solicitation* webpage on the NSF (n.d.) website.

Study Methods

Purpose

The study described in this article evaluated an intervention designed to teach innovation skills to graduate nursing students and its potential contribution to their understanding and ability to innovate nursing problems. The purpose of this quantitative pre-post study was specifically to evaluate an online innovation and design thinking (I&DT) module and its impact on self-empowerment, self-efficacy, and innovative capacity in a sample of graduate nursing students. The research questions were:

1. Do graduate nursing students exposed to a modified synchronous online NSF I-Corps module demonstrate an increase in self-empowerment, self-efficacy, and innovative capacity?
2. Does the I&DT module support students creating their own innovation for their assignment nursing problem?

Design

We used a pre-post single cohort design. All participants were graduate nursing students participating in our required 3-credit hour graduate level course on safety and quality. Students were surveyed using a self-reported online data collection tool at the beginning and at the completion of the I&DT module. This study was deemed exempt by the University of Wisconsin Milwaukee IRB.

The NSF I-Corps program was adjusted and implemented as a module into our existing course. This primarily asynchronous online course included the I&DT module consisting of four synchronous online sessions to work through the modified NSF I-Corps module. The goal was to innovate a stubborn nursing problem. Students worked in small teams, used white-boarding technology, and presented their innovation as a prototype via a storyboard during the final session. To assess the impact of the module on student understanding of the steps of innovation, they completed a survey about their experiences and insights gained. For further information about the I&DT modules, readers can contact the lead author.

Students worked in small teams, used white-boarding technology, and presented their innovation as a prototype via a storyboard during the final session.

Population and Sample

Study participants consisted of a cohort of registered graduate nursing students pursuing doctorate in nursing (DNP) or master's in nursing (MN) degrees. Participating cohorts were registered for the course between Summer 2022 and Fall 2023, which comprised four sessions of the course. The total number of participating students is n= 94. For the purpose of the study, only matched pre-post participants (n=45) were used to evaluate the impact of the I&DT module.

Data Collection Instruments

In this study we measured creative self-efficacy (Tierney & Farmer, 2002), psychological empowerment (Menon, 2001), and traits of design thinkers (Blizzard et al., 2015; Coleman et al., 2020). Creative self-efficacy evaluates whether participants believe they can be creative in their work roles. The Creative Self-efficacy instrument has a 7-point Likert Scale with values ranging from 1, very strongly disagree to 7, very strongly agree. The Creative Self-efficacy instrument has been tested and evaluated with a Cronbach's Alpha of 0.83-0.87. (Tierney & Farmer, 2002)

Creative self-efficacy evaluates whether participants believe they can be creative in their work roles.

The Psychological Empowerment scale (Menon, 2001) considers that the psychological experience of power underlies feelings of empowerment. Goal internalization, perceptions of control over the work environment, and perceptions of self-efficacy or competence are major components of empowerment. The implications of defining empowerment as a psychological state and the need for multiple measures of empowerment are also discussed. The Psychological Empowerment scale (Menon, 2001) has been widely used with established reliability of a Cronbach alpha for the subscales of perceived control (.86), perceived competence (.78), and goal internalization (.86). This scale uses a 6-point Likert scale, ranging from 1 strongly disagree, to 6 strongly agree.

The Traits of Design Thinking scale, developed by Blizzard and colleagues (2015; Coleman et al., 2020), is used to identify specific traits that favor design thinking and innovation. The Traits of Design Thinking scale includes the characteristics of design thinking: collaboration, experimentalism, optimism, feedback-seeking, and integrative thinking. Blizzard et al. (2015)

analyses found that design thinking traits correlated with higher achievement; with a desire for careers helping others and solving societal problems. The Traits of Design Thinkers instrument uses a 5-point Likert Scale (0-Strongly disagree to 4-strongly agree) and has a reported Cronbach's alpha of 0.76.

Data Collection Procedure

Data collection took place via anonymous online survey forms and included basic demographic items and study surveys. Students designed a personal code that was used for the pre- and post-survey, allowing the researchers to match these two surveys. However, no identifying information was retained, and faculty were not aware of student reporting until the post-test was analyzed. Surveys were collected before the start of the first I&DT module and immediately after the completion of the fourth module. Other items for the student evaluation were the storybooks of prototypes prepared by the student teams.

Study Intervention

The study intervention was the I&DT module, which consisted of four 1-hou**r** synchronous online sessions. The sessions were held every other week for eight weeks, starting in week 5 of the semester. The content of the four sessions was adapted from the NSF I-Corps customer discovery processes, with fundamental human-centered design methods supporting the understanding of approaching problems from the users' perspective (Altman et al., 2018; Beckman & Barry, 2007).

The objectives of the I&DT module were to expose the students to design thinking and, in a small group, apply this process to a stubborn nursing problem. From a pedagogical perspective, students engaged in an active-learning experience working in small teams, reporting out, and presenting their work.

Students were introduced to essential design methods, including problem-finding and framing ideation, prototyping, and problem-solution testing (Plattner et al., 2010). Using the course online learning platform, students were randomly assigned in groups of four to five students and assigned a stubborn nursing problem (e.g., communication, patient-facing technology, mobilization). MURAL™, a virtual whiteboard, facilitated synchronous and asynchronous communication within the small groups.

Students were introduced to essential design methods, including problem-finding and framing ideation, prototyping, and problem-solution testing

Active learning exercises were embedded in the course to prime the students' mindset to identify as innovators and to recognize practice-related problems. In the first session, students identified ways they have modified (aka "MacGyvered") products, processes, and/or technology to deliver patient-centered care more efficiently and effectively. Session 1 content focused on examples of poor design and the concept of "Norman Doors" (i.e., doors that fail to indicate whether they need to be pushed or pulled to open) (Norman, 2013). This content helped students identify healthcare products, processes, and workflows that were a safety or quality risk due to a gap in design or not understanding user needs.

Between sessions 1 and 2, each group member interviewed at least three people who they identified as customers or stakeholders affected by the problem. During session 2, students discussed the interview insights and created an archetype (i.e., typical user description) of the person who experienced the problem. Then, students complete a *How might we* (HMW) statement (e.g., *How might we help newly graduated nurses improve communication during patient handoff*?). During session 3, student groups ideated or brainstormed potential solutions based on the interview insights and different personas potentially affected by their solution.

Finally, in session 4, students developed a storyboard visually depicting the I&DT process (i.e., Emphasize, Define, Ideate, Prototype, and Test). The small groups also created an elevator pitch to describe their problem and solution (e.g., "Optimize communication to ensure a safe transition of care"). They presented their elevator pitch and storyboard to the large group to gather feedback. Students were invited to participate in a reflection survey after each I&DT session.

Statistical Analyses

Demographics. Descriptive analyses were conducted to describe the study participants. Pre-and post-test responses were paired using the unique identifier generated by the student. Where the unique identifiers did not match, or no unique identifier was entered, manual comparison of demographic information was compared to reconcile the records. The total number of students registered for the classes was n=94. The analytic sample comprised 94 (100%) pre-survey un-reconciled records , 62 (66.0%) post-survey un-reconciled records, and 45 (48.9%) reconciled records. As the study was designed as a pre-post matched study, a final sample of 45 was used for the analyses; results were compared with the grouped sample (n = 94) participants.

Active learning exercises were embedded in the course to prime the students' mindset to identify as innovators and to recognize practice-related problems.

Demographic characteristics were calculated and compared across class times. Because the demographic information provided during the pre-and post-test surveys was not different, only pre-test responses were used to describe the sample. Categorical variable differences were evaluated using the Chi-square or Fisher's exact tests. The ANOVA was used to evaluate the means of the continuous variables.

Study Concepts. Question item responses were assigned numeric values. All scales used Likert-type reporting which was adopted for the surveys. For the instrument and construct, "Creative self-efficacy", the value 1 signified very strong disagreement with the statement, and 7 signified very strong agreement. For the instrument and their constructs, "Psychological empowerment" and "Traits of design thinkers", 1 signified strong disagreement, and 5 signified strong agreement, except for three items where it signified the reverse. These three items were reverse coded for the purposes of the analyses. Please refer to Tables 2 and 3 in the Results section for the detailed survey concepts.

Outcomes analyzed were at the construct level – the collection of question items at either the instrument level or the subscale level. Of the three instruments, "Creative self-efficacy" did not have subscales; "Psychological empowerment" has 3 subscales (goal internalization, perceived control, and perceived competence), and "Traits of design thinkers" has 5 subscales (feedback seeking, integrative thinking, optimism, experimentalism, and collaborations).

An unadjusted mean comparison of the pre-test responses across class sessions was attempted. The same was performed for the post-test responses. Due to a low count of 3 reconciled records in the 2023 Fall session, the means were compared between years instead using the two samples t-test. Pre- and post-test responses were then analyzed using linear mixed effects regression accounting for the class session. The unique identifier was the random effect. The pre-/post-test survey and class session year variables were modeled as fixed effects. The same analyses were conducted in the unmatched cases (n = 94) to assess whether differences existed in pre-post survey results that could be attributed to the characteristics of the groups.

The R programming language (version 4.4.1) was used for data management and all analyses (R Core Team, 2023). The supporting R packages used were: dplyr (version 1.1.4), magrittr (version 2.0.3), nlme (version 3.1-164), and lubridate (version 1.9.3). Statistical tests were considered significant at the α level ≤ 0.05. When evaluating the outcomes, the Bonferroni-corrected α level used was 0.05/11 = 0.0045. (Bonferroni,)

Results

Demographics Findings

Table 1 includes a description of the participants where pre- and post-survey results could be matched for analyses (n = 45). Comparisons between the different classes indicated no significant differences in age, race/ethnicity, or gender. Of note, few (10%) male student nurses participated, which reflects the predominant female presence in the nursing profession. Half of the participants identified as white (given multiple possible options). The number of DNP and MN students was nearly equal; however, more MN students attended the course during the summer semester. Over a quarter (25.7%) of the participants were board-certified when they took the course. Forty percent of the students self-identified as first-generation college degree students. Additional analyses included all students (n = 94) who participated in the course during the study timeframe; for the larger group, we found no significant differences in demographic characteristics between the various groups.

Table 1. ***Descriptive Characteristics of Reconciled (matched) Pre-Survey Module Participant Records***

		Reconciled Pre-survey Records								
	Survey Time	**2022 Summer**		**2022 Fall**		**2023 Summer**		**2023 Fall**		***p*-value†**
	n	**17**		**9**		**16**		**3**		
Age										0.79
18 to 24 years old		1	5.9	1	11.1	1	6.2	0	0	
25 to 34 years old		8	47.1	7	77.8	10	62.5	3	100	
35 to 44 years old		6	35.3	1	11.1	3	18.8	0	0	
45 to 54 years old		2	11.8	0	0	1	6.2	0	0	
55 to 64 years old		0	0	0	0	1	6.2	0	0	

Race/Ethnicity, any									
Asian	3	17.6	3	33.3	2	12.5	0	0	0.49
Black or African American	2	11.8	2	22.2	0	0	1	33.3	0.20
Native American, American Indian, or Alaskan Native	1	5.9	0	0	2	12.5	0	0	0.63
Native Hawaiian, or Pacific Islander	17	100	9	100	16	100	3	100	-
White	12	70.6	4	44.4	15	93.8	2	66.7	0.06
Hispanic/Latin/Spanish									0.17
unspecified	0	0	0	0	1	6.2	0	0	
No	17	100	9	100	14	87.5	2	66.7	
Yes	0	0	0	0	1	6.2	1	33.3	
Gender									0.66
Female	12	70.6	9	100	15	93.8	3	100	
Male	3	17.6	0	0	1	6.2	0	0	
Non-binary / third gender / non-conforming	1	5.9	0	0	0	0	0	0	
Prefer not to say	1	5.9	0	0	0	0	0	0	
Program									0.37
Doctor of Nursing Practice (DNP)	7	41.2	7	77.8	7	43.8	3	100	
Master of Nursing (MN)	9	52.9	2	22.2	8	50	0	0	
Other	1	5.9	0	0	1	6.2	0	0	
Board Certification	12	70.6	6	66.7	7	43.8	2	66.7	0.43
First generation student, Yes	6	35.3	3	33.3	8	50	1	33.3	0.79

Pre-Post Survey Evaluations

Table 2 presents the pre and post-test scores for the instruments, “Creative self-efficacy,” “Psychological empowerment,” and “Traits of design thinkers.” Table 2 shows no statistically significant differences at the instrument and construct level for the group comparisons, indicating that the baseline values of the study pre- and post-groups did not differ. One exception is the

subscale Experimentalism, which was included in the Traits of Design Thinkers instrument and showed a significant difference in the post-measurements. All other subscales did not show statistically significantly different values between the study groups.

Table 2. ***Question Item Mean Responses by Year - Reconciled Records of I&DT Module***

	Pre-test					Post-test				
Class session year	**2022**		**2023**		**t-test *p*-value**	**2022**		**2023**		**t-test *p*-value**
n	**26**		**19**			**26**		**19**		
Construct	**Mean**	**SD**	**Mean**	**SD**		**Mean**	**SD**	**Mean**	**SD**	
Creative self-efficacy	**4.67**	**1.03**	**4.89**	**0.92**	**0.19**	**5.05**	**1.22**	**5.51**	**0.91**	**0.01***
Psychological empowerment	**3.98**	**0.78**	**3.94**	**1.05**	**0.65**	**4.23**	**0.74**	**4.29**	**0.80**	**0.47**
1. Goal Internalization	3.95	0.70	3.96	1.01	0.92	4.36	0.62	4.33	0.64	0.82
2. Perceived Control	3.72	0.91	3.58	1.21	0.45	3.95	0.92	4.00	1.05	0.76
3. Perceived Competence	4.28	0.60	4.28	0.77	0.99	4.39	0.54	4.54	0.54	0.13
Traits of design thinkers	**4.00**	**0.97**	**3.93**	**0.95**	**0.48**	**3.99**	**1.03**	**4.10**	**1.13**	**0.29**
1. Feedback Seeking	4.66	0.48	4.66	0.48	0.98	4.53	0.50	4.82	0.39	0.01*
2. Integrative Thinking	3.16	1.19	3.29	1.06	0.59	3.19	1.25	3.32	1.42	0.66
3. Optimism	3.60	0.87	3.45	0.95	0.44	3.67	0.94	3.57	1.07	0.62
4. Experamentalism	4.27	0.53	4.18	0.56	0.47	4.37	0.56	4.53	0.56	0.18
5. Collaboration	4.31	0.78	4.08	0.85	0.19	4.22	1.05	4.26	1.13	0.84

*Indicates significance at the 0.05 level.

Table 3 presents the results of the linear mixed-effects model to determine whether a statistical difference can be detected between the pre-survey and post-survey results. The results show highly significant differences for creative self-efficacy ($p < .001$), psychological empowerment ($p<.001$), and statistically significant differences for the subscales goal internalization, perceived control, and perceived competence. For the traits of design thinkers instrument, no statistical differences were noted; however, one subscale, Experimentalism, demonstrates a significant difference between the pre-and post-survey results ($p<.005$). Though not included in a table, the same analyses were conducted for the total sample ($n = 95$); similar significant differences were observed. Significant differences were noted between the creative self-efficacy and psychological empowerment instruments following the intervention. The traits of design thinkers were only significant for one subscale (experimentalism).

Table 3. ***Pre- and Post-Test Mean Responses, by Year of Class Session - Reconciled Records of I&DT Module***

	Un-adjusted Means					Regression Estimates**			
	Pre-test		Post-test			Pre- (ref.) or post-test response		In 2023 (2022, ref.)	
Construct	**Mean**	**SD**	**Mean**	**SD**		**Est.**	***p*-value**	**Est.**	***p*-value**
Creative self-efficacy	**4.76**	**0.99**	**5.24**	**1.12**	**0.48**	**<0.00***		**0.34**	**0.11**

Psychological empowerment	**3.97**	**0.90**	**4.26**	**0.77**	**0.29**	**<0.00***	**0.01**	**0.94**
1. Goal Internalization	3.96	0.84	4.34	0.63	0.39	<0.00*	-0.01	0.98
2. Perceived Control	3.66	1.04	3.97	0.98	0.31	0.00*	-0.04	0.85
3. Perceived Competence	4.28	0.68	4.45	0.54	0.17	0.00*	0.08	0.58
Traits of design thinkers	**3.99**	**0.96**	**4.01**	**1.08**	**0.07**	**0.30**	**0.02**	**0.81**
1. Feedback Seeking	4.69	0.47	4.62	0.49	-0.01	0.89	0.14	0.18
2. Integrative Thinking	3.27	1.17	3.19	1.29	0.03	0.86	0.13	0.49
3. Optimism	3.53	0.90	3.63	0.99	0.09	0.49	-0.13	0.45
4. Experamentalism	4.23	0.54	4.43	0.56	0.20	0.01*	0.04	0.74
5. Collaboration	4.22	0.82	4.22	1.07	-0.02	0.85	-0.09	0.61

*Indicates significance at the 0.05 level. ** Linear mixed-effects models following the equation: construct ~ pre-/post-test response + year of class session + (1|unique student identifier).

Evidence of Student Innovations

The second research question was posed to investigate whether the students could produce an innovation for their assigned problem. (**AUTHORS: I only see one research question introduced above – can we add the second one in that section**?) Student groups were asked to prepare a prototype of their solution in the form of a storyboard. All the student groups were able to use the empathize, define and ideate (i.e., brainstorm) results, and incorporate user-interview feedback to present a prototype solution to the problem they were assigned. Figure 1 show two prototype examples prepared by student teams.

Figure 1. ***Storyboard Samples of Graduate Nursing Student Innovations for the Problem "Communication"***

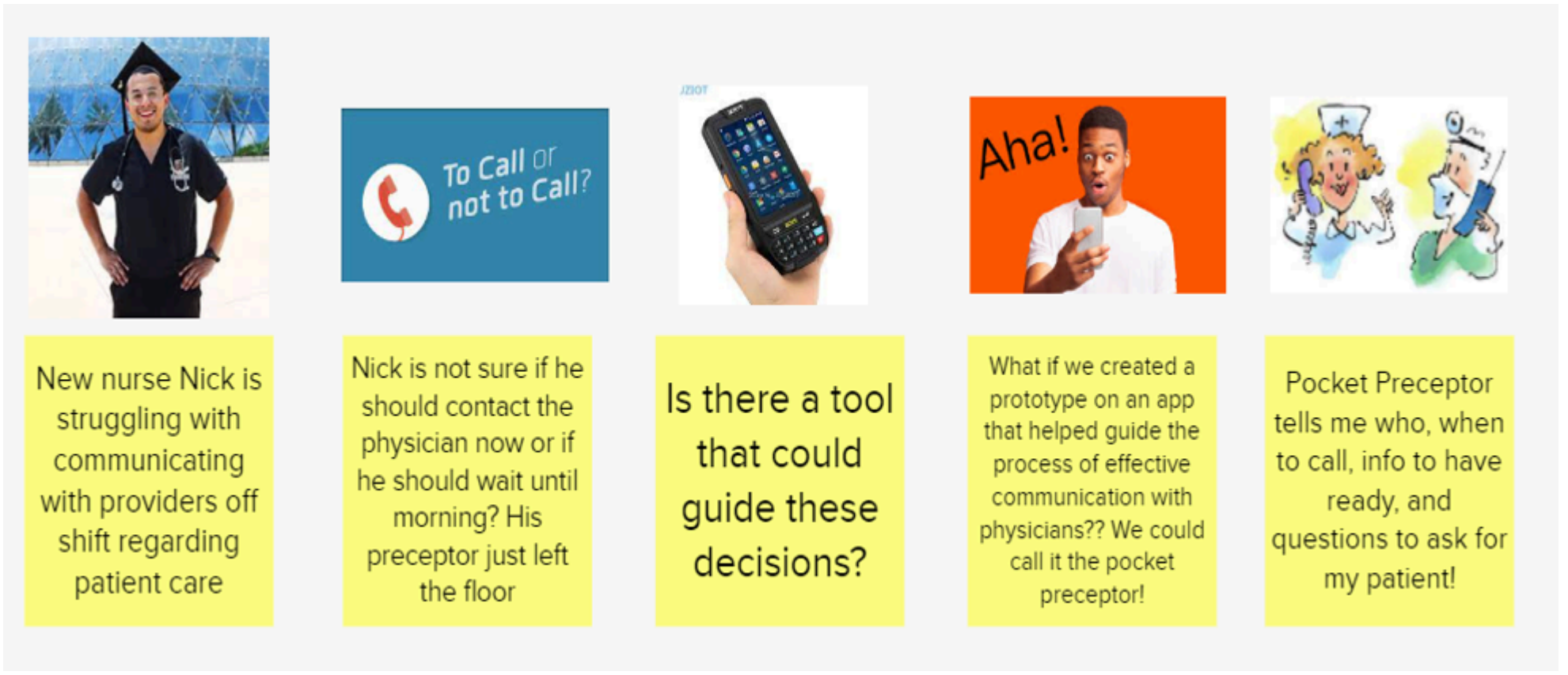
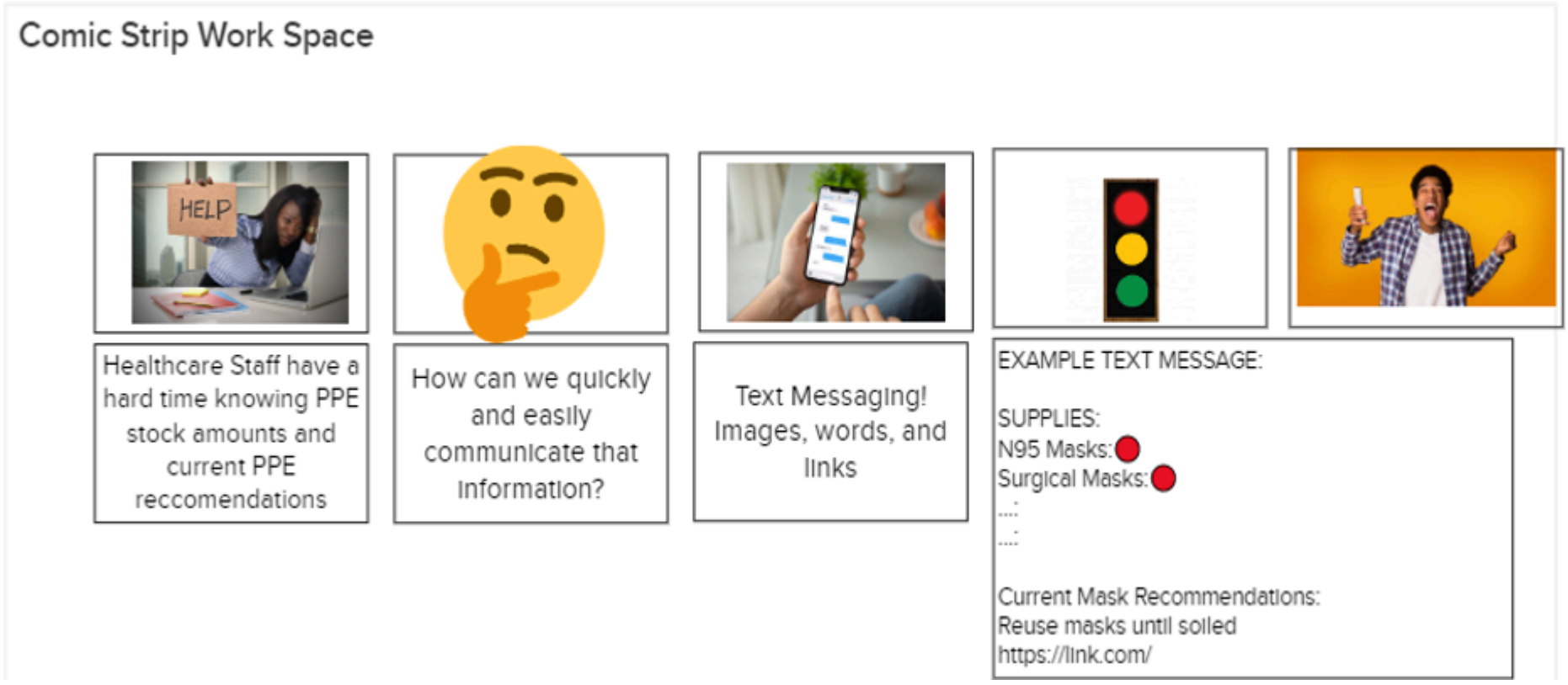


Figure 2. ***Storyboard Samples of Graduate Nursing Student Innovations for the Problem "PPE Supply"***



The *Communication* student group problem included frustrations of a new nurse; this nurse frequently had questions, but mentors were not always available to assist. The group proposed to develop an app that would guide new nurses through the intricacies of the job, offering support in addition to their mentor. Figure 1 stemmed from the frustration that unit nurses do not know the personal protective equipment (PPE) supply in their hospital and whether they need to save supplies or request additional supplies elsewhere. This leads to many phone calls and wastes time, whereas, with this innovation, they could check the app to see the PPE supply status. The students in this group asserted that this app would also be helpful in the context of many other supplies. The prototype presentation demonstrated that the students could successfully take the appropriate steps in an abbreviated and intensified schedule. At the same time, team building and networking were mentioned by students as some of the added benefits.

Discussion

To our knowledge, this is the first study to describe and implement a synchronous online I&DT module for graduate nursing students to meet the AACN competencies that include the concept of innovation. While not addressed in detail in this article, student reflections also confirmed their ability to apply I&DT skills to develop an innovation addressing a common healthcare problem. Our results demonstrated that four 1-hour online sessions were adequate to introduce the concepts of I&DT and apply these concepts to address a stubborn healthcare problem. The innovations the students prepared were of sufficient quality, i.e., they would be accepted as a topic to address for the NSF I-Corps application and similar student start-up programs.

Student Experience

We found that presenting stubborn nursing problems (e.g., ambulation, communication, or sleep) motivated students to innovate. They created a common language and focus, rather than students brainstorming their individual group topic for innovation. Topics could be applied to any healthcare scenario; for example, one group focused on a sleep innovation for intensive care unit patients and another focused on an innovation related to addressing sleep issues for new nurses adjusting to night shifts. Students commented that they enjoyed the team-based project and appreciated the various perspectives from interviews and working with other students.

We found that presenting stubborn nursing problems...motivated students to innovate.

Using online tools (e.g., Mural™, Zoom™) was critical to facilitate interactions and share work during online sessions. However, a learning curve to familiarize teams with the whiteboard features and Mural™ functionality, setup, and management of virtual breakout rooms should be anticipated. Several students commented about the usefulness and benefit of such communication modalities that facilitate teamwork and collaboration and noted that these could be used in their work environments.

Nursing Innovation

Nurses must be at the development and design table and understand the language of innovation and design thinking (Eines et al., 2019; Holt et al., 2022) to participate in innovations. Our study demonstrated that the Psychological *Empowerment and Creative Self-Efficacy* instruments showed significant change between the pre-and post-measurement, and the students felt empowered to innovate and use I&DT language following the online module. Only one of the constructs covered in the Traits of a Design Thinker instrument, Experimentalism, showed a significant increase in the matched sample. The participants were not a self-selected group with a known interest

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or awareness of design thinking and innovation, this may have impacted the results on this instrument. The findings also support students' increased sense of innovative capacity, creativity, and confidence. Students were eager to learn and apply newly acquired I&DT skills and stated they used these learned concepts in their practice to resolve conflicts and develop alternative solutions.

Our study findings add new knowledge to the nursing literature about the components of the I&DT sessions and demonstrate the importance of integrating I&DT content into graduate student level curricula. However, additional research is needed to determine whether nursing students exposed to I&DT methodologies during graduate school indeed demonstrate increases in creative self-efficacy (Tierney & Farmer, 2002, 2011), design-thinking traits (Coleman et al., 2020), and psychological empowerment (Avey et al., 2008) in their professional roles.

...many healthcare and medical innovations focus on groundbreaking technologies rather than addressing wasteful technical and practical problems.

We observed that student-proposed nursing interventions often addressed practice problems with equipment, clinical practice, and processes that contribute to redundancies and inefficiencies and were described as 'pain points.' Due to poorly designed technologies, many healthcare and medical innovations focus on groundbreaking technologies rather than addressing wasteful technical and practical problems. Faculty leaders guiding college of nursing programs have a unique opportunity to include I&DT content for graduate nursing students as they consider the new AACN *Essentials* (2021) and curriculum revision and development.

Limitations

This study was implemented at one midwestern university; most students were drawn from within the same state. The graduate nursing students were required to take the quality and safety course; therefore, there was no control group. Future studies should include multiple sites and comparison groups and compare these I&DT skills for PhD and undergraduate nursing and health professions students.

Conclusion

All nurses are innovators, but many have yet to be educated in the specific skills required and the processes that move an innovative concept to a viable solution.

Our graduate nursing students exhibited a deep innovative capacity that was readily deployed and applied in the online module that focused on innovation. Students commented on the usefulness and application of these skills, confirming a gap in their knowledge and an eagerness to learn and gain competency in such skills. Evaluations and student reflections indicated their increased sense of empowerment and efficacy, recognizing practices and processes that would benefit from innovations and skills to approach this in their work environment.

These graduate student reflections provide a foundation of evidence that creative self-efficacy, design-thinking traits, and empowerment may increase after engaging in I&DT experiential and learning. Future research must explore how these characteristics improve after graduate students participate in and learn about I&DT methodologies, and then move to advanced practice roles in the healthcare environment. All nurses are innovators, but many have yet to be educated in the specific skills required and the processes that move an innovative concept to a viable solution.

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References

Albert, N. M. (2018). Operationalizing a nursing innovation center within a health care system. *Nursing Administration Quarterly, 42*(1), 43–53. https://doi.org/10.1097/NAQ.0000000000000266

Altman, M., Huang, T. T. K., & Breland, J. Y. (2018). Design thinking in health care. *Preventing Chronic Disease, 15*, E117. https://doi.org/10.5888/pcd15.180128

American Association of Colleges of Nursing. (2021). *AACN Essentials*. Retrieved from https://www.aacnnursing.org/AACN-Essentials

Avey, J. B., Hughes, L. W., Norman, S. M., & Luthans, K. W. (2008). Using positivity, transformational leadership, and empowerment to combat employee negativity. *Leadership & Organization Development Journal, 29*(2), 110–126. https://doi.org/10.1108/01437730810852470

Barr, T. L., Malloch, K., Ackerman, M. H., Raderstorf, T., & Melnyk, B. M. (2021). A blueprint for nursing innovation centers. *Nursing Outlook, 69*, 66–72. https://doi.org/10.1016/j.outlook.2021.05.006

Beckman, S. L., & Barry, M. (2007). Innovation as a learning process: Embedding design thinking. *California Management Review, 50*(1), 25–56. https://doi.org/10.2307/41166415

Blank, S. (2013, May 1). Why the lean start-up changes everything. *Harvard Business Review*. Retrieved from https://hbr.org/2013/05/why-the-lean-start-up-changes-everything

Blizzard, J., Klotz, L., Potvin, G., Hazari, Z., Cribbs, J., & Godwin, A. (2015). Using survey questions to identify and learn more about those who exhibit design thinking traits. *Design Studies, 38*, 92–110. https://doi.org/10.1016/j.destud.2015.02.002

Brown, T., & Watt, J. (2010, Winter). Design thinking for social innovation. *Stanford Social Innovation Review*. Retrieved from https://ssir.org/articles/entry/design_thinking_for_social_innovation

Coleman, E., Shealy, T., Grohs, J., & Godwin, A. (2020). Design thinking among first-year and senior engineering students: A cross-sectional, national study measuring perceived ability. *Journal of Engineering Education, 109*(1), 72–87. https://doi.org/10.1002/jee.20298

Cosier, S. (2017, May 2). 8 medical inventions created by nurses. *Mental Floss*. Retrieved from https://www.mentalfloss.com/article/500467/8-medical-inventions-created-nurses

Dennis, M. (2012, January 19). Small beginnings: Sharon Rogone and medical supplies for babies. *The Atlantic*. Retrieved from https://www.theatlantic.com/health/archive/2012/01/small-beginnings-sharon-rogone-and-medical-supplies-for-babies/251604/

Eines, T. F., Angelo, E., & Vatne, S. (2019). Discourse analysis of health providers' experiences using service design. *Nursing Open, 6*(1), 84–92. https://doi.org/10.1002/nop2.191

Hagle, M., Dwyer, D., Gettrust, L., Lusk, D., Peterson, K., & Tennies, S. (2020). Development and implementation of a model for research, evidence-based practice, quality improvement, and innovation. *Journal of Nursing Care Quality, 35*(2), 102–107. https://doi.org/10.1097/NCQ.0000000000000422

Holt, J. M., Talsma, A., Woehrle, L. M., Klingbeil, C., & Avdeev, I. (2022). Fostering innovation and design thinking in graduate programs. *Nurse Educator, 47*(6), 356–357. https://doi.org/10.1097/NNE.0000000000001206

Melles, M., Albayrak, A., & Goossens, R. (2021). Innovating health care: Key characteristics of human-centered design. *International Journal for Quality in Health Care: Journal of the International Society for Quality in Health Care / ISQua, 33*(Supplement_1), 37–44. https://doi.org/10.1093/intqhc/mzaa127

Menon, S. (2001). Employee empowerment: An integrative psychological approach. *Applied Psychology, 50*(1), 153–180.

National Academies of Sciences, Engineering, and Medicine. (2021). *The future of nursing 2020-2030: Charting a path to achieve health equity*. The National Academies Press. https://doi.org/10.17226/25982

Newby, J. C., Mabry, M. C., Carlisle, B. A., Olson, D. M., & Lane, B. E. (2020). Reflections on nursing ingenuity during the COVID-19 pandemic. *The Journal of Neuroscience Nursing: Journal of the American Association of Neuroscience Nurses, 52*(5), E13–E16. https://doi.org/10.1097/JNN.0000000000000525

Nightingale, F. (1859). *Notes on nursing: What it is, and what it is not.* Harrison and Sons.

Norman, D. (2013). *The design of everyday things: Revised and expanded edition*. Basic Books. Retrieved from https://play.google.com/store/books/details?id=nVQPAAAAQBAJ

O'Leary, M. (2020, November 20). The innovation cycle and the nursing process—they go together! *American Nurse*. Retrieved from https://www.myamericannurse.com/the-innovation-cycle-and-the-nursing-process-they-go-together/

Phillips, J., Carr, A., Guesman, K., Foreman-Lovell, M., Levesque, P., Lukas, B., Parent, K., Snyder, D., & Grant, S. (2021). The impact of nurse-led innovations and tactics during a pandemic. *Nursing Administration Quarterly, 45*(3), 234–242. https://doi.org/10.1097/NAQ.0000000000000480

Plattner, H., Meinel, C., & Leifer, L. (2010). *Design thinking: Understand – improve – apply.* Springer Berlin Heidelberg. Retrieved from https://play.google.com/store/books/details?id=jjvHNAEACAAJ

Schriver, J. A., Talmadge, R., Chuong, R., & Hedges, J. R. (2003). Emergency nursing: Historical, current, and future roles. *Academic Emergency Medicine: Official Journal of the Society for Academic Emergency Medicine, 10*(7), 798–804. https://doi.org/10.1111/j.1553-2712.2003.tb00076.x

Szanton, S. L., Leff, B., Li, Q., Breysse, J., Spoelstra, S., Kell, J., Purvis, J., Xue, Q.-L., Wilson, J., & Gitlin, L. N. (2021). CAPABLE program improves disability in multiple randomized trials. *Journal of the American Geriatrics Society, 69*(12), 3631–3640. https://doi.org/10.1111/jgs.17383

Talsma, A. N., Bleich, M., Dolansky, M., White, K., & Barton, A. J. (2020). Evidence of Nightingale as a design thinker. *American Academy of Nursing Policy Conference.* October 29-31, 2020 [Virtual].

Tierney, P., & Farmer, S. M. (2002). Creative self-efficacy: Its potential antecedents and relationship to creative performance. *Academy of Management Journal, 45*(6), 1137–1148. https://doi.org/10.2307/3069429

Tierney, P., & Farmer, S. M. (2011). Creative self-efficacy development and creative performance over time. *The Journal of Applied Psychology, 96*(2), 277–293. https://doi.org/10.1037/a0020952

U.S. National Science Foundation. (n.d.). NSF 21-552: Innovation Corps - National Innovation Network Teams Program (I-CorpsTM Teams) Program Solicitation. Retrieved from https://www.nsf.gov/pubs/2021/nsf21552/nsf21552.htm

White, K. R., Pillay, R., & Huang, X. (2016). Nurse leaders and the innovation competence gap. *Nursing Outlook, 64*(3), 255–261. https://doi.org/10.1016/j.outlook.2015.12.007

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