EFFECT OF DESIGN THINKING TRAINING PROGRAM ON NURSE MANAGERS' AWARENESS AND INNOVATIVE MANAGERIAL SKILLS

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Abstract

Background: Enhancing nurse managers' awareness and innovation through design thinking is critical for advancing healthcare leadership and improving patient outcomes. A quasi-experimental design was employed, utilizing pre-test and post-test to assess knowledge and an observational checklist to measure innovative managerial skills. The study was conducted at the National Heart Institute, Egypt, with 30 nurse managers participating. Results revealed a highly statistically significant improvement in design thinking knowledge across program phases, as demonstrated by ANOVA (F=23.32, p=0.00) and Chi-square analysis (χ2=29.57, p=0.00). While a slight decline in knowledge was observed during the follow-up phase, levels remained above the baseline. Additionally, the innovative managerial skills of nurse managers significantly improved, with mean percentages reaching satisfactory levels of 90% post program and 76.3% at follow-up, compared to an unsatisfactory preprogram baseline. Conclusion: The program effectively enhanced nurse managers' knowledge and innovative skills, demonstrating its value in improving managerial competencies in healthcare settings.

Keywords: Nurse Managers, Design Thinking, Innovative Managerial Skills.

1. INTRODUCTION

Design thinking, a human-centered problem-solving approach, offers transformative potential for nursing management. By emphasizing empathy, collaboration, and iterative innovation, it enables nurse managers to address complex challenges like workflow inefficiencies and patient dissatisfaction. [1] This methodology fosters creative, patient-centered solutions by focusing on root causes, such as redesigning admission workflows to improve staff efficiency and enhance patient experiences. [2]

Implementing design thinking training programs equip nurse managers with tools to drive innovation, improve team collaboration, and adapt to dynamic healthcare needs. [3] Inclusive practices, such as co-creating solutions with interdisciplinary teams, enhancing morale, reducing burnout, and fostering a culture of continuous improvement. Ultimately, design thinking supports operational excellence and sustainable, patient-centered care. [4]

Application of design thinking approaches within healthcare can help drive necessary innovation in care delivery models. There is no one 'right' or easy answer to the challenges healthcare faces now or in the future, but this design thinking framework offers an accessible and recognizable approach for discovering, developing, and delivering services that better align with individual and community needs. [5], [6].

In fact, support for any major organizational change begins with innovation focused. Many organizational leaders require training and coaching to enable them to model and support innovative thinking among their staff. [7]. Once trained, visibly sustaining this behavior over time will demonstrate to employees the value of design thinking and continue to help build a sustainable culture of innovation. [8],[9]. This study helps the nurses to innovate through the adoption of design thinking as a way and method for innovation and support granted from their managers who value creativity and innovation.

2. METHODS

2.1 Aim

This study was conducted to evaluate the effect of design thinking training program on nurse managers' awareness and innovative managerial skills. To achieve the aim of the current study the following research hypotheses were postulated:

H$_1$: There will be a significant difference in the mean score of design thinking awareness among nurse managers immediately after implementation of program and 3 months later as compared to before program measured by knowledge assessment questionnaire.

H$_2$: There will be a significant difference in the mean score of innovative managerial skills among nurse managers immediately after implementation of program and 3 months later as compared to before program measured by innovative managerial skills observational checklist.

2.2. Design

A quasi-experimental design (one group pretest-posttest) was used to achieve the aim of the current study.

2.3 Setting

This study was carried out at national heart institute Founded in 1964, (NHI) is a 360-bed, teaching hospital with services and programs in cardiology and cardiac surgery. The institute offers a full range of cardiac health care services. Key services include Cardiovascular Services, Cardiac Surgery Services, Emergency Department, which include Pediatric, Adult and Urgent Care Cardiac Emergency Center and Outpatient Clinic Services. NHI is the most specialized Egyptian center that serve tens hundred thousand of cardiac patients yearly. According to a statistical report published on the official NHI web site the institute served around 18 thousand cardiac catheterization, 3200 cardiac surgery, 341 thousand outpatients and 110 thousand patients at emergency department.

2.4. Participants

The study sample consisted of 30 nurse managers employed at the National Heart Institute, selected using a convenient sampling method.

2.5. Data Collection Tools

The current study data was collected using the following two tools:

First tool: Design thinking awareness tool. It was a developed tool by the investigator after extensive reviewing of related literature to assess the nurse managers` level of knowledge about design thinking. [10], [11], [12], [13], [14]. The study tool consisted of two parts.

The first part focused on personal characteristics, including variables such as age, gender, residence, marital status, educational level, years of experience, workplace, and participation in training courses related to managerial innovation.

The second part was design thinking knowledge and divided into fifteen multiple choice questions; five were matching questions and five true false questions, with a total of 25 questions which asked about design thinking importance, design thing process, design thinking in application.

The scoring system of awareness assessment was either zero for (incorrect answers), or one for (correct answers). The minimum score was (0) and the maximum score was (25). The total knowledge score was categorized into two categories (a) Unsatisfactory level of knowledge (less than 60%). (b) Satisfactory level of knowledge (≥ 60%).

Second tool: Innovative managerial skills observational checklist. An observational checklist that was adapted from (Sabry, 2022). [18]. It consists of 7 domains with a total of (42 items): Divergent thinking (6 items), Risk taking and monitoring (8 items), Failure tolerance (7 items), Flexibility (4 items), Organized feedback and rewarding (5 items), Participative decision making (6 items), Autonomy and freedom (6 items). The scoring system for nurse manager innovative managerial checklist was zero for (Not done), one for (Not applicable) and two for (Done). The minimum score was (0) and the maximum score was (84). The total innovative managerial skills checklist score was categorized into two categories (a) Unsatisfactory level of managerial innovation skills (less than 60%). (b) Satisfactory level of managerial innovation skills (≥ 60%).

Both tools were checked for their validity and reliability. Content validity was established by a panel of three experts from nursing administration department at faculty of nursing, Cairo University. Furthermore, the reliability was determined statistically by testing the internal consistency using Cronbach's Alpha Coefficient test. The Cronbach's Alpha for Design thinking awareness tool was (0.79) while the Innovative managerial skills observational checklist reliability was (0.8).

2.6. Procedure

The procedure was concluded in five phases: preparatory, assessment, planning, implementation, evaluation and follow-up phase.

I- **Preparatory phase:** This phase involved an extensive review of recent related literature to develop data collection tools. The design thinking awareness tool was then translated into Arabic to ensure it was comprehensible to the nurse managers. Additionally, the tool was validated for accuracy and clarity.

II- **Assessment phase:** the initial assessment was conducted after explaining the aim, nature, and significance of the study by the investigator to the director of the hospital and head nurses of the selected units to gain permission to take their participation approval. The assessment was done by distributing the design thinking knowledge test questionnaire to the nurse managers in their work units to complete it by themselves in order to assess their knowledge and to identify their learning needs. As well as nurse managers' innovative managerial skills were measured by the investigator through utilizing the observational checklist. Every nurse manager was observed at three different times using intermittent observations pre and post and after three months of program implementation. The time spent for each nurse managers to answer the design thinking knowledge test questionnaire was 20 to 35 minutes. While the investigator took about 45 minutes to 1 hour to observe each nurse manager for innovative managerial skills.

III- **Planning phase:** based on the initial assessment data analysis, the investigator identified the nurse managers training needs and developed the program on design thinking in English version, translated into Arabic as well as its validity was reviewed by the nursing administration experts. Accordingly, the program plan was established.

IV- **Implementation phase:** the design thinking training program was carried out. The program was conducted in six sessions, one hour duration for each session with a total of 6 hours in-service classrooms teaching offered in two sessions per week. The session repeated as needed according to nurse manager's time.

V- **Evaluation and follow-up phase:** The immediate impact of the educational program was evaluated using the same knowledge questionnaire and observational checklist used during the assessment phase. Follow-up evaluations were conducted three months after program implementation, again utilizing the same tools, to assess the long-term effects and ensure the reliability of the program.

2.7. Statistical data analysis

The collected data was organized, computed, and statistically analyzed using IBM Statistical Package for The Social Sciences (SPSS) software version 24 (SPSS Inc., Chicago, IL, USA). Both descriptive and inferential statistics were applied, including frequency distribution, percentages, means, standard deviations, Repeated Measures ANOVA, and Pearson's correlation coefficient (r).

3. RESULTS

Table 1 demonstrates that the majority of the nurse managers in the study were female (93.3%). Most participants were married (90%) and resided in urban areas. Over half of the nurse managers (60%) were between the ages of 41 and 50. Additionally, 60% held a diploma degree, and 83% held the position of head nurse. More than half (60%) had 20 to 30 years of experience, and none of the participants had attended any training courses related to managerial innovation.

Table 2 illustrates that there was a highly statistically significant difference (F= 23.32, P=0.00) as indicated by Anova and chi square ($\chi 2$ = 29.57, p = 0.00) among the nurse managers regarding design thinking knowledge through different program phases. The results demonstrate that the intervention significantly improved nurse managers' knowledge of design thinking. Although some knowledge decline occurred in the follow-up phase, the levels remain above the initial baseline.

Figure 1 shows that Pretest Phase: In the pretest, 100% of nurse managers scored in the "unsatisfactory" category, indicating a low baseline level of knowledge regarding design thinking prior to any intervention. Posttest Phase: After the intervention, there was a significant improvement, with 66.7% achieving a "satisfactory" knowledge level, while 33.3% remained "unsatisfactory." This reflects a substantial gain in knowledge following the training. Follow-up Phase: In the follow-up phase, the percentage of nurse managers with "satisfactory" knowledge slightly decreased to 43.3%, while those in the "unsatisfactory" category increased to 56.7%. This decline suggests some knowledge retention loss over time, though the "satisfactory" levels are still notably higher than in the pretest. The intervention led to a marked improvement in knowledge immediately after training, as shown in the posttest. However, the follow-up results indicate that while some knowledge was retained, there was a decrease in satisfactory scores over time.

Table 3 illustrates that significant statistical differences (p<0.05) were found in both the total innovative managerial skills of nurse managers and all dimensions across the different assessment periods. Post-test and follow-up scores were higher than pre-test scores, except for the "risk-taking" (p=0.10) and "participative decision-making" (p=0.57) domains, which showed no significant statistical differences during the different assessment periods.

Table 4 indicates that significant statistical differences (p<0.05) were observed in both the total innovative managerial skills of nurse managers and across all dimensions during the various periods of assessment. The post-test and follow-up scores showed improvement compared to the pre-test, except for the "participative decision-making" domain (p=0.59), where no significant statistical differences were found across the assessment periods.

Table 5 reveals that there was a statistically non-significant correlation (r = 0.08, p = 0.66) between the design thinking training program and the innovative managerial skills of nurse managers immediately after the program's implementation. However, this

correlation shifted to a weak yet statistically significant level (r = 0.41, p = 0.03) during the follow-up phase.

Table 1: Frequency and percentage distribution of sociodemographic characteristics among Nurse managers (N= 30)

Sociodemographic characteristics		NO.	%
Age:	20-30 years	2	6.7
	31-40 years	1	3.3
	41-50 years	18	60
	51-60 years	9	30
	Mean± SD		45.73±7.58
Gender:	Male	2	6.7
	Female	28	93.3
Marital status:	Married	27	90
	Widow	3	10
Place of residence:	Rural	3	10
	Urban	27	90
Educational Level:	Diploma	18	60
	Bachelor	11	36.7
	Master	1	3.3
Experience	<10 years	3	10
	10- <20 years	4	13.3
	20- <30 years	18	60
	≥30 years	5	16.7
	Mean± SD		24.73±8.32
Current position:	Charge nurse	2	6.7
	Head nurse	25	83.3
	Supervisor	1	3.3
	Assistant director	1	3.3
	Director	1	3.3
Place of Work:	Emergency and surgical	18	60
	Inpatient and outpatient	6	20
	Infection Control	1	3.3
	Nursing Office	2	6.7
	Quality	3	10
Attending training courses related to managerial innovation:	No	30	100

Table 2: Comparison of design thinking knowledge means score among nurse managers (Pre-program, post-program, and follow up 3months later) (n=30)

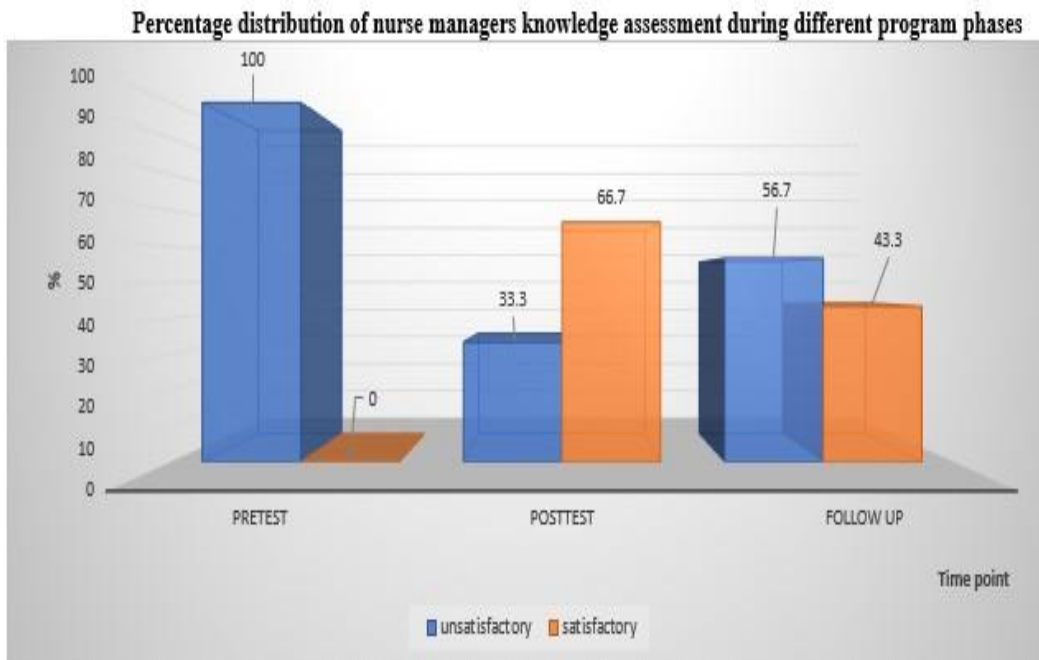| nurse managers knowledge	Pretest		Post test		Follow up		Repeated measures Anova		Chi square	
	NO.	%	NO.	%	NO.	%	F	P	χ2	P
Satisfactory	0	0	20	66.7	13	43.3			29.57	0.00
Unsatisfactory	30	100	10	33.3	17	56.7				
Total mean score and standard deviation	10.9 ± 2.34		17.3 ± 3.84		15.1 ± 4.58		23.32	0.00		

*P value is significant at ≤0.05

Figure 1 Comparing nurse managers total knowledge level during different periods of assessment (pre-test- post-test – follow-up) (n=30)

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Table 3: Comparing Mean Scores of nurse managers innovative skill Domains during Different Periods of Assessment (Pre-program- Post-program – Follow-Up) (n=30)

Skills dimensions	Pretest		Posttest		Follow up		Repeated measures ANOVA	
	Mean	SD	Mean	SD	Mean	SD	F	P
Divergent thinking	5.50	2.58	8.27	3.27	7.63	3.23	6.80	0.00
Risk taking and Monitoring	10.60	5.01	12.57	2.13	12.03	3.23	2.32	0.10
Failure tolerance	6.70	4.17	10.33	3.24	9.37	3.88	7.42	0.00
Flexibility	3.60	2.19	4.83	1.42	4.60	1.81	3.83	0.02
Organized feedback & rewarding	6.40	3.89	10.13	2.62	8.87	3.41	9.64	0.00
Participative decision making	6.70	4.09	7.57	2.85	7.50	3.42	0.57	0.57
Autonomy and Freedom	4.80	3.31	9.20	3.43	7.87	3.79	12.38	0.00
Total practice	44.30	18.59	62.90	12.16	57.87	16.22	11.01	0.00

*P value is significant at ≤0.05

Table 4: Comparing total Scores of nurse managers innovative skill Domains during Different Periods of Assessment (Pre-program- Post-program – Follow-Up) (n=30)

Skills dimensions	Pretest				Posttest				Follow up				Chi square	
	Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	χ^2	P
Divergent thinking	27	90	3	10	17	56.7	13	43.3	20	66.7	10	33.3	8.55	.01
Risk taking and Monitoring	15	50	15	50	2	6.7	28	93.3	5	16.7	25	83.3	16.73	.00
Failure tolerance	18	60	12	40	2	6.7	28	93.3	7	23.3	23	76.7	21.27	.00
Flexibility	24	80	6	20	6	20	24	80	11	36.7	19	63.3	23.21	.00
Organized feedback & rewarding	15	50	15	50	4	13.3	26	86.7	8	26.7	22	73.3	9.84	.01
Participative decision making	12	40	18	60	16	53.3	14	46.7	14	46.7	16	53.3	1.07	.59
Autonomy and Freedom	24	80	6	20	5	16.7	25	83.3	10	33.3	20	66.7	26.34	.00
Total practice	18	60	12	40	3	10	27	90	7	23.3	23	76.7	18.77	.00

*P value is significant at ≤0.05

Table 5: Correlation between design thinking knowledge and innovative managerial skills among nurse managers at different program phases (n=30)

Pearson's correlation	Preprogram	Post program	Follow up
r	.28	.08	.41
P	.13	.66	.03

*P value is significant at ≤0.05

4. DISCUSSION

The current study found that the sociodemographic profile of the 30 nurse managers highlights a predominantly middle-aged (mean 45.7 ± 7.58 years), female group (93.3%), with most residing in urban areas (90%) and holding intermediate professional qualifications (60% diploma, 36.7% bachelor's degree). Participants had significant experience (mean 24.7 ± 8.32 years), with 83.3% serving as head nurses across diverse units at the health setting. Notably, none had prior training in managerial innovation, emphasizing the critical need for programs like design thinking training to address gaps in leadership development. These findings suggest opportunities for enhanced education, gender diversity, and rural-urban training equity in nursing leadership.

Concerning nursing managers' knowledge test scores of design thinking, the present study postulated that there were discernible differences in the knowledge test scores of the nursing staff about design thinking following program implementation and at a three-month follow-up, as compared to the pretest scores. The findings substantiated this hypothesis, demonstrating statistically significant variations in the mean knowledge scores of nursing staff across different periods of assessment, particularly concerning design thinking knowledge dimensions.

The highest mean scores were recorded immediately after the program's implementation and slightly decreased at a three-month follow-up, indicating enhanced knowledge about patient safety post-intervention. These results underscore the positive impact of the implemented program on the nursing managers' understanding of design thinking.

From the researcher's point of view, the observed significant improvement in the nursing managers knowledge post-implementation of the design thinking training program was due to the utilization of teaching methodologies that foster interaction and collaboration in the learning process.

In addition, repetition contributed to creating a dynamic and interactive education among nurse managers. Another potential factor that could explain this marked improvement is the novelty of some of the design thinking program concepts for the participants. Therefore, they are motivated to acquire and update their knowledge.

The results presented in the study align with the findings of other researchers.[15] demonstrated that integrating design thinking into healthcare leadership training equips nurse managers with tools to foster innovation, improve team dynamics, and enhance overall organizational performance. Similarly,[20] found that design thinking programs in professional settings significantly boost knowledge and skills, especially when combined with follow-up activities to reinforce learning.

The result that the intervention significantly improved nurse managers' knowledge of design thinking is opposed by some studies that question the efficacy of such training programs in achieving long-term or practical outcomes as in a research who argue that while design thinking training may improve theoretical understanding, it often fails to translate into practical skills without real-world application and continuous practice. [16] They highlight a gap between knowledge acquisition and practical implementation. Also, Ceschin and Gaziulusoy (2020) highlight the risk of knowledge decay post-training, arguing that without sustained reinforcement or organizational support, initial gains from training interventions often diminish over time, reducing their practical value. [17]

The findings of this study reveal a significant improvement in nurse managers' innovative managerial skill levels over time. Mean scores reached a satisfactory level of 90% at the posttest and remained relatively high at 76.3% during the follow-up phase. These results highlight the effectiveness of the intervention in enhancing innovative managerial competencies, particularly in comparison to the pretest scores, which were initially unsatisfactory. These results are consistent with the findings of research [18], who reported that targeted training programs significantly improved nurse managers' capacity

for innovation by fostering critical thinking, problem-solving, and adaptive leadership skills. Similarly, research found that sustained improvement in managerial innovation is achievable through continuous professional development, even in challenging healthcare environments. [19].

However, the slight decline in scores at the follow-up stage (from 90% to 76.3%) suggests the potential influence of external barriers, such as organizational resistance, workload pressures, or a lack of ongoing support. This aligns with the work of [24], who noted that while initial training boosts skills, the absence of reinforcement mechanisms can lead to skill attrition over time.

To sustain high levels of innovative managerial skills, it is crucial to implement periodic refresher programs and create an enabling environment that encourages experimentation and creative problem-solving. Future studies should explore the long-term impact of such interventions and identify strategies to mitigate the factors contributing to the decline observed during follow-up assessment

Finally, the current study revealed a statistically significant positive correlation ($r = .41$, $p = 0.03$) between nurse managers' participation in a design thinking training program and their innovative management skills at the follow-up stage. This indicates that engaging in design thinking processes contributes to the enhancement of innovative managerial competencies, supporting the role of creative problem-solving methodologies in nursing leadership development.

This result aligns with research, [20] who found that design thinking programs equip nurse managers with tools to approach challenges creatively and systematically, resulting in improved decision-making and innovative leadership behaviors. Similarly, [21] reported that incorporating design thinking into leadership training enhanced participants' ability to generate and implement innovative solutions, particularly in dynamic healthcare settings.

On the other hand, [22] argued that the impact of design thinking training on managerial innovation might vary depending on contextual factors, such as organizational culture and resource availability. They observed that while some managers benefited significantly, others faced implementation challenges, leading to only marginal improvements in their innovative skills. From a theoretical perspective, the correlation in this study supports the premise that design thinking fosters divergent thinking, empathy, and iterative problem-solving, which are core components of innovative management. However, the moderate correlation coefficient ($r = .41$) suggests that other factors, such as prior experience, team dynamics, or organizational support, might also contribute to the development of innovative skills.

Future research should examine additional factors that may influence the effectiveness of design thinking and explore ways to integrate it with other leadership development strategies. Longitudinal studies are also recommended to investigate whether the observed improvements are sustained over time and how these improvements translate into measurable outcomes in healthcare practice.

5. CONCLUSION AND RECOMMENDATIONS

In the light of the present study's findings, it can be concluded that there was a statistically significant difference in the mean scores of knowledge test regarding design thinking among nurse managers immediately post-program implementation and three months later compared to pre-program. Additionally, there was a statistically significant difference in both nurse managers' total innovative management skills and all dimensions immediately post-program implementation and three months later compared to pre-program. Accordingly, there was a positive effect of implementing an educational program about design thinking for nurse managers to equip them with the knowledge and practices needed to apply innovation in the health care work setting. Based on these results, the study recommends the establishment of clear innovative management strategies for nurse managers, developing guidelines in the form of posters, quick reference cards, manuals or booklets, and designing policies that emphasize the importance of design thinking practices in fostering innovation on a daily basis.

Furthermore, it is recommended to integrate in-service education and training programs focused on design thinking, and to provide opportunities for staff nurses to attend out-service educational activities, such as conferences, workshops, seminars, and meetings with design thinking experts. Moreover, nursing curricula should incorporate design thinking methodology at various levels. Nursing schools should organize regular workshops to offer students and faculty members updated information and potential applications of design thinking. Finally, the study suggests that replication of the study with a larger sample size in different settings could help confirm and generalize the findings.

DECLARATIONS

Ethical Considerations

Formal approval was granted from the Ethical Committee of Scientific Research at Faculty of Nursing, Cairo- University. Also, an official permission to conduct the study was obtained from the hospital administrators. Participation in the study is voluntary and based on the participants' agreement.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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