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RESEARCH ARTICLE

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Effectiveness of a nursing innovation workshop at enhancing nurses' innovation abilities: A quasi-experimental study

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Abstract

Aim: To investigate the effectiveness of nursing innovation workshop in enhancing clinical nurses' innovation ability and research ability in a tertiary hospital.

Design: A quasi-experimental study design.

Methods: Thirty-seven recruited nurses participated in a nursing innovation workshop for half a year in a tertiary hospital in Guangdong between June 2019 and March 2020. Questionnaire data on the nurses' self-rated innovation and research abilities were collected before the training and 3 months after completing the training. Wilcoxon signed rank tests were used to analyse differences within the group before and after the intervention. The level for statistical significance was set at $p \leq .05$ (two-tailed).

Results: Nurses' self-rated innovation ability ($p < .001$, 95% confidence interval 12.79 to 15.05) and research ability ($p < .001$, 95% confidence interval 14.39 to 19.09) improved significantly after the training. Since the whole design lacked a control group, the study needs to be further verified in more hospitals and among more nurses.

KEYWORDS
innovation ability, nurses, research ability, workshop

1 | INTRODUCTION

In response to the rapid development and progress of science and technology, hospitals have promoted healthcare innovations to develop highly efficient and economical patient-centred care environments (Weng et al., 2016). As a key force in healthcare services, nurses must constantly innovate to keep pace with the health industry and improve the quality of care (Yan et al., 2020). The American Nurses Association (ANA) defined nurses' innovation ability as the ability to actively seek and develop new methods, new technologies and new tools to promote health, prevent diseases, improve the quality of care of patients, and apply innovation to work through teamwork and reasonable support channels (ANA2016). Yan et al., (2018) defined nurses' innovation ability as the ability to actively seek and develop new methods, new technologies and new tools to promote health, prevent diseases, improve the quality of care of patients, and apply innovation to work through teamwork and reasonable support channels. This study adopts this definition, which includes four elements: innovation subject, innovation process, innovation environment and pressure and innovative products (Yan et al., 2018).

2 | BACKGROUND

In most health systems across the world, nurses provide up to 80% of primary health care (Shahsavari Isfahani et al., 2015). Nurses are critical thinkers on the front lines of care delivery who often innovate by identifying more efficient processes or repurposing items for

alternate uses; they are therefore uniquely positioned to improve clinical practice through such ideas (Croke, 2019; Timmermans et al., 2012). Fostering innovative nursing ability could improve medical service quality, increase job productivity, improve the effectiveness of treatment, reduce healthcare costs while satisfying the needs of patients, improve the effectiveness of care services, improve access to healthcare services and simplify the process involved in delivering such services (Clark & Webster, 2012; Gardner et al., 2010; Liu et al., 2020; Weng et al., 2016; Whyte, 2016).

Scholars have developed different strategies to address the lagging innovation ability of clinical nurses (Moore et al., 2012; Snow, 2019), and they include providing education and training on innovation processes and lean techniques, scheduling time for brainstorming among teams and solving problems together, providing resources, such as financial, information, personal, and emotional support, and actively adjusting the talent cultivation model to meet the current need for innovative nursing talent for the development of healthcare services (Albert, 2018; Croke, 2019; He et al., 2019; Li-Ying et al., 2016; Sun & Ye, 2015). While these contextual factors are important, innovations will not occur unless basic knowledge of innovation and research is provided to motivated and competent nurses (Li-Ying et al., 2016).

Studies have found that cultivating nurses' research ability has benefits in promoting the nursing discipline (Purkis et al., 2008), improving leadership (Severinsson, 2014), enhancing patient-centred care (Landeen et al., 2017) and facilitating innovation development (Muccioli et al., 2007). A large sample survey from China showed that nurses' scientific research participation rates (with 4.1%, 7.9%, 5.4% and 2.0% in research projects, research attendance, papers published and patents respectively) and their self-rated research skills 25.00 (95% confidence interval 12.50 to 37.50) were very low (Wu et al., 2019). However, their research training needs were relatively high at 53.12 (95% confidence interval 37.50 to 75.00) (Wu et al., 2019). In our previous study, we found that 89.2% of nurses had a weak research ability (M. Wang et al., 2019). Therefore, research training with content tailored to individual characteristics and capacities should be provided for nurses.

A workshop is a method for solving problems in which individuals (between 25 and 40 people) who are in the same scientific or technical field attend through activities, discussions, short lectures and other approaches (Yazdani et al., 2015). It is a collaborative and constructive teaching organization that involves attracting participation, provoking thought, and promoting interaction and growth (Zhou, 2016). The methods of case analysis, role play, group sharing, group discussion, brainstorming, teacher commenting and behaviour training have been widely used in foreign countries (Lai, 2011; Li et al., 2012; Yonge et al., 2012). In nursing, researchers highly emphasize the use of workshops for nursing education, professional development and clinical skills and have not focussed on their use as a nurse innovation enhancement tool and scientific research methodology (Grugnetti et al., 2014; Li et al., 2012; Zhou, 2016).

The level of innovation ability of nurses in China and abroad differs. Polster & Villines, (2017) investigated 217 clinically Registered Nurses from a midwestern urban Magnet teaching hospital with 408 beds in Chicago, United States, and found that 90.3% had good innovative ability. However, Stilgenbauer and Fitzpartick, (2019) conducted a survey in the American Organization of Nurse Executives newsletter, and it was graded using the Scales for Measurement of Innovativeness to measure innovativeness. These researchers found that nursing managers and clinical specialists generally had a high level of innovative abilities and behaviours compared with general clinical nurses. Compared to these studies, there is an obvious shortage of nursing innovation talent in China. Zhang and Wang, (2015) conducted a survey of 587 nurses from three tertiary hospitals in Harbin in 2017, and the results showed that the average innovative behaviour score of nurses was 2.71 ± 0.62 (the highest score was 5). Similarly, Chen et al., (2020) investigated the innovation ability of 1,260 clinical nurses in Zhengzhou in 2019 and found that the innovation ability of nurses was at a medium level, and the score of the innovation product subscale was the lowest (3.18 ± 0.86) (the highest score was 5). Nurses' position, professional title, working years, leadership and job satisfaction as well as the organizational innovation climate were the main factors affecting their innovation ability (Lv et al., 2018; Wang, 2018; Xiang & Xiong, 2018).

In China, nurses' level of care and corresponding salaries are determined by a state-established professional title rating system. This system grades from low to high level and is divided into junior nurses, supervisor nurses, deputy chief nurses and chief nurses. The promotion of professional titles requires nurses not only to have routine nursing abilities but also to have strong innovation and research abilities. Few studies have been performed assessments of nurse's innovation ability trainings (Chen et al., 2020; He et al., 2019; Jiang et al., 2017; Yan et al., 2018), and most nurses have great training demands.

Can nursing innovation workshop enhance nurses' innovation ability? What is the effect of the enhancement? We hypothesized that nurses who were given the opportunity to participate in the nursing innovation workshop would nurture and enhance their innovation ability. We further predicted that they would get higher research ability with provided innovative thinking training over time. Moreover, we hypothesized that they would have more nursing innovations or research output in future work.

2.1 | Aim

The aim of the study is to investigate the effectiveness of nursing innovation workshop in enhancing clinical nurses' innovation ability and research ability in a tertiary hospital.

3 | THE STUDY

3.1 | Design

A quasi-experimental study was designed to find out whether a nursing innovation workshop could improve the innovative and research abilities of nurses.

3.2 | Methods

3.2.1 | Settings and participants

A pre-test and post-test quasi-experimental study was conducted at a tertiary hospital in Nanhai District, including one group with baseline data and follow-up assessment data.

The innovative teamwork excellence nursing innovation workshop was promoted through the internal hospital website and the nurses' WeChat group. Clinical nurses who met the criteria were recruited for this study. The inclusion criterion was Registered Nurses who had worked for more than 1 year. The exclusion criteria were as follows: (a) Registered Nurses who did not work in the hospital during the investigation period (including those who went out for further study and sick leave) and (b) Registered Nurses who were participating in other teaching programmes or studies. A total of 627 nurses met the recruitment criteria. According to the literature review, we found that the sample size of the workshop should be between 25 and 40 people (Grugnetti et al., 2014; Yazdani et al., 2015). The optimal sample size calculation was based on the results of previous research and the results of using G*Power3 (Faul et al., 2007). An a priori paired *t* test indicated that a total sample size of 35 was needed to achieve 80% power to detect an interaction effect size of 0.50 at the 0.05 level of significance. Considering that there might be a potential 10% attrition rate during the programme, a total of 39 participants were targeted in this study. Ultimately, 37 participants (5.9% of total) were enrolled in the study. All the participants completed the study.

According to the recruitment situation, the group was divided into 4 groups of 8–10 people. The innovation team leader was selected based on the investigation by the research team and the recommendation of the innovation team members. The team leader was required to have an intermediate or above professional title, obtain one or more patents and have solid knowledge of innovation and scientific research capabilities with a rigorous and pragmatic academic attitude and good communication skills (Jiang et al., 2017). The responsibilities of the team leader were to lead the members to implement innovation and offer consultation to the members.

Research Ethics Committee approval of this study was granted by the Ethics Committee of the People's Hospital of Nanhai District Foshan, Guangdong. The nurses received information about the study and voluntary participation and provided informed consent before data collection. Furthermore, the participants were informed that they had the right to withdraw from the study at any time without any explanations or consequences.

3.2.2 | Intervention

An innovative teamwork excellence nursing innovation workshop was administered by a research team composed of 8–10 members, including one director and one deputy director of the nursing department, one ward head nurse, one research nurse, one clinical evidence-based nursing tutor, one director of nursing education and 2–4 education nurses from different wards. Their responsibilities were to establish a workshop team, recruit members, conduct research on innovation, formulate training content for scientific research and innovation, and contact relevant experts to organize and implement learning on relevant topics.

According to the recruitment situation and considering the balance of the number of people in each group, facilitating group discussion and activities, 37 participants were divided into 4 teams of 8–10 people. The innovation team leader was selected based on the investigation by the research team and the recommendation of the innovation team members. The team leader was required to have an intermediate or above professional title, obtain one or more patents and have solid knowledge of innovation and scientific research capabilities with a rigorous and pragmatic academic attitude and good communication skills. The responsibilities of the team leader were to lead the members to implement innovation and offer consultation to the members. The other 33 nurses were distributed according to their work departments (including internal medicine, surgery, gynaecology, critical care and other departments), professional title, education and years of work so that the levels of the four groups were similar.

The team leader was responsible for leading the members to implement innovations and offering consultations. A questionnaire to investigate participants' training motivation, training methods, scientific research innovation experience and relevant factors affecting their training was completed (Jiang et al., 2017; Zhang et al., 2019). Then, a specific learning course (including both theoretical training and practical training) was conducted based on the results of the questionnaire (Table 1). The 12-hr theoretical training courses lasted 6 weeks (2 hr/week) and were mainly taught and guided by experienced experts. The content involved current innovation policies, innovative thinking training and patent development, application and transformation. At the end of the theoretical course, members of each group were required to choose their own topics and conduct a product demand survey and innovative design to realize their creative ideas. Practical training involved conducting innovations to solve clinical problems and ultimately producing prototypes of products. Competition for patented products was done to enhance the participants' innovative spirit after completing the practical training.

3.2.3 | Measurements

Nurses' innovation ability was assessed using the Scale of Clinical Nursing Staff Innovation Ability (Table S1) (Yan et al., 2018). This scale was divided into 4 dimensions with 41 items, including the nurses' innovation subjects (17 items), innovation process (12 items), innovation environment and pressure (7 items) and innovative products (5 items) (Yan et al., 2018), and it was a five-point ordinal scale (1–5) with a maximum score of 205 points, with a higher score corresponding to higher innovation ability (Yan et al., 2018). Relevant studies showed that the scale-level content validity index (S-CVI)

TABLE 1 Course table of the innovation workshop

Course	Theme	Aim	Content	Time
Theoretical training (once a week for two hours)	Project introduction	Understanding the purpose of the workshop and the rationale for the curriculum design	Introduction to the purpose of establishing the workshop and designing the course content	0.5 hr
	Progress in nursing innovation development	Acquiring the knowledge of nursing innovation development	1. Introduction to the future direction of nursing innovation 2. Understanding the current innovation policy 3. Introduction to the application and transformation process of some nursing innovative products	1.5 hr
	Innovative design thinking	Cultivating innovative design thinking and incorporating it into practice	1. Introduction to the concept and characteristics of innovative design thinking 2. Understanding the difference between innovative design thinking and traditional thinking	2 hr
			3. Introduction to the thinking tools: brainstorming, divergent and convergent creative thinking	2 hr
			4. Learning how to implement creative design thinking steps: requirement observation, literate review, theme formulation, scheme design, feasibility analysis, action plan, scheme promotion	4 hr
			5. Learn how to sketch a product design	2 hr
Practical training (18 week)	Discover stage	Identifying clinical problems and exploring patient needs	Each group chooses its own innovation theme through communication, division of labour and research	4 week
	Design stage	Proposing innovative design schemes and from prototypes	The team collaborates to propose innovative design solutions for the theme and forms a preliminary product prototype	10 week
	Deliver stage	Displaying and promoting final innovative solutions and products	Submit innovative proposals to the research team for first review	2 week
			Hold nursing innovation competition, report and promote innovative programmes	2 week

was 0.953, the Cronbach's α coefficient was 0.938, and the test–retest reliability was 0.67 (Chen et al., 2020; Yan et al., 2018). In our study, the Cronbach's coefficients of this scale before and after the intervention were 0.789 and 0.945 respectively.

Nurses' research ability was assessed using the Scale of Nursing Scientific Research Ability (Table S2) designed by Yin-he Pan from Shanxi Medical University in China. This scale has 6 dimensions and 30 items, including the ability to generate research ideas (3 items), the ability to search and review literature (5 items), the ability to design a research protocol (5 items), the ability to conduct research (6 items), the ability to analyse research data and material (5 items) and the ability to write a research report (6 items) (Pan & Cheng, 2011). The scale was a five-point ordinal scale (0–4) with a maximum score of 120 points; a higher score represents a higher level of research ability (Pan & Cheng, 2011). Relevant studies have shown that the Cronbach's α coefficient of the total scale was 0.861, the Cronbach's α coefficient of each dimension was 0.655~0.760, and the correlation coefficient of the total scale of test–retest reliability was 0.902 after one month (Pan & Cheng, 2011). In our study, the Cronbach's coefficients of this scale before and after the intervention were 0.946 and 0.973 respectively.

The researcher created all questionnaires through an online anonymous thematic survey website (https://www.wjx.cn/). The leader of each team set up each own WeChat group for communication. The researchers assessed all the participants by distributing the online questionnaires to each WeChat group and recollecting the questionnaires. Assessments of innovation and research abilities were carried out at baseline (before workshop) and 3 months postworkshop (follow-up) (Tables S1–S3). Additionally, a sociodemographic questionnaire was used to assess the baseline characteristics, including gender, age, education background, professional title, length of service, nursing duties and departments.

3.3 | Data analysis

Statistical analyses were conducted using SPSS 22.0 (IBM Corp.) statistical software. The general data of the clinical nurses were described by the frequency, percentage, mean and standard deviation. Because the variables were not normally distributed, the clinical nurses' scores for innovation ability and scientific research ability were described by the median and interquartile range. Wilcoxon signed rank tests were used to analyse differences within the group before and after the intervention. The level for statistical significance was set at $p \leq .05$ (two-tailed).

4 | RESULTS

The demographic characteristics of the participants are listed in Table 2. The sample included 37 nurses ranging in age from 27 to 48 years, with a mean age of 38 years. The 4 groups in this research were parallel repeated experiments, and there was no significant difference among the innovation ability scores and research ability scores of the four groups ($p > .05$).

4.1 | Innovation ability scores

The improvement of the innovative products was the highest. The innovative product scores increased by 23.1% from baseline to the 3-month follow-up ($Z = -5.20$, $p < .001$, 95% CI range 2.11 ~ 2.98). Second, the innovation environment and pressure scores increased by 16.7% from baseline to the 3-month follow-up ($Z = -5.19$, $p < .001$, 95% CI range 2.85 ~ 4.01). Third, the innovation process scores increased by 11.9% from baseline to the 3-month follow-up ($Z = -5.33$, $p < .001$, 95% CI range 3.21 ~ 4.25). Last, the innovation subject scores increased by 4.9% from baseline to the 3-month follow-up ($Z = -5.32$, $p < .001$, 95% CI range 3.56 ~ 4.87). The total score of innovation ability increased by 10.7% from baseline to the 3-month follow-up ($Z = -5.32$, $p < .001$, 95% CI range 12.79 ~ 15.05) (Table 3).

5 | RESEARCH ABILITY SCORES

The improvements of the ability to generate research ideas, ability to search and review literature and ability to conduct research were both the highest. The ability to generate research ideas scores increased by 50% from baseline to the 3-month follow-up ($Z = -5.19$, $p < .001$, 95% CI range 1.57 ~ 2.32). The ability to search and review scores increased by 50% from baseline to the 3-month follow-up ($Z = -5.11$, $p < .001$, 95% CI range 2.83 ~ 4.42). The ability to conduct research scores increased by 50% from baseline to the 3-month follow-up ($Z = -5.26$, $p < .001$, 95% CI range 2.65 ~ 3.84). Then, the ability to design research scores increased by 28.6% from baseline to the 3-month follow-up ($Z = -4.49$, $p < .001$, 95% CI range 1.98 ~ 3.53). Next, the ability to write research report scores increased by 25% from baseline to the 3-month follow-up ($Z = -4.89$, $p < .001$, 95% CI range 2.35 ~ 3.97). Last, the ability to analyse research data and material scores increased by 20% from baseline to the 3-month follow-up ($Z = -4.81$, $p < .001$, 95% CI range 1.84 ~ 3.08) (Table 4). Statistical analysis results indicated that all scores of research and innovation ability were increased significantly after the workshop at the 3-month follow-up.

6 | DISCUSSION

This study aimed to investigate the effectiveness of a nursing innovation workshop in enhancing clinical nurses' innovation and research abilities. A one-group pre-test, post-test quasi-experimental design was conducted in this study. After the workshop (follow-up), the median innovation ability and research ability scores of the nurses increased significantly ($p < .001$).

TABLE 2 Sociodemographic characteristics and training demands of clinical nurses participating in the nursing workshop ($n = 37$)

Characteristic	*N* (%)	Characteristic	*N* (%)
Gender		No	22 (60.4)
Male	2 (5.4)	Department	
Female	35 (94.6)	Internal medicine	12 (32.5)
Age (years)		General surgical	11 (29.7)
27 ~ 30	3 (8.11)	Gynaecology and paediatrics	4 (10.8)
31 ~ 40	25 (67.57)	Critical care unit	4 (10.8)
41 ~ 48	9 (24.3)	Other[a]	6 (16.2)
Foundational education		Main training motivation	
Technical secondary school	10 (27.1)	Promotion needs	12 (32.4)
Junior college	15 (40.5)	Job demand	12 (32.4)
Bachelor's degree	12 (32.4)	Self-improvement	13 (35.2)
Highest academic credential		Training methods (multi-select)	
Bachelor's degree	35 (94.6)	Case analysis	35 (94.6)
Master's degree	2 (5.4)	Role play	5 (13.5)
Professional title		Group discussion and sharing	30 (81.1)
Junior nurse	5 (13.51)	Brainstorm	32 (86.4)
Supervisor nurse	17 (46.0)	Expert comments	32 (86.4)
Deputy chief nurse	13 (35.1)	Number of patents	
Chief nurse	2 (5.4)	0	33 (89.2)
Length of service (years)		1	2 (5.4)
3 ~ 10	4 (10.8)	2	2 (5.4)
11 ~ 20	24 (64.9)	Innovation influencing factors (multi-select)	
21 ~ 30	9 (24.3)	Busy work	30 (81.1)
Head nurse		Lack of innovation knowledge	30 (81.1)
Yes	15 (40.6)	Reward factor deficiency	15 (40.6)

[a]Others refer to operating rooms, outpatient clinics and supply rooms.

Similarly, quasi-experimental studies (Jiang et al., 2017, Liu et al., 2020, Zhang et al., 2019) that aimed to assess the effect theory-driven training improved nurses' innovation behaviour. Compared with the above similar studies, our research established a better workshop that achieved better results and provided more credible evidence. First, the workshop was established and guided by tutors with rich innovation experience and provided an open culture that embraced innovativeness and empowered nurses to advance new ideas, enhance interactions, improve their self-confidence and self-esteem and exert an obvious positive influence on individual innovation behaviour (Joseph, 2015; Syme & Stiles, 2012; Zhang & Liu, 2017). Second, the training content, which was based on the core elements of innovation ability and the actual training needs of clinical nurses identified via a preliminary survey, removed the constraints of the traditional thinking mode, emphasized the stimulation of members' independent thinking and learning ability and opened up a new way of nursing innovation education; meanwhile, the usage of social media WeChat as a tool of recruitment and follow-up survey made the workshop more friendly and flexible to participants. Third, the duration of the workshop was 24 weeks, which allowed participants to have a more flexible time schedule to attend courses with minimum influence on their clinical work. We introduced competition in practical courses that allowed our participants to more actively apply their newly learned knowledge to real cases. The scale of innovation ability scores and research ability scores were used to assess the effect of the workshop in this research. Statistical analysis results indicated that all scores of research and innovation ability increased significantly after the workshop at the 3-month follow-up.

Additionally, Chen et al., (2019) reported that clinical and academic collaboration is a precondition of high-quality nursing studies, which was helpful to our study. The workshop in our study was divided into theoretical and practice courses. After 12 hr of participation in the workshop with different themes, the participants could recognize the concept of nursing innovation and basic steps and promote scientific research thinking and critical thinking. In

TABLE 3 Clinical nurses' innovation abilities at baseline and follow-up with change over time in the group (N = 37)

			△Score			
Measurement factors	**Baseline**	**Follow-up**	**Median score (IQR)**	***Z* value**	***P* value**	**95% CI range**
Innovation subjects	61.00 (54.50,65.00)	64.00 (59.50,69.50)	4.00 (2.50 ~ 6.00)	−5.32	<0.001	3.56 ~ 4.87
Innovation process	42.00 (39.50,45.00)	47.00 (43.00,48.00)	4.00 (2.00 ~ 5.00)	−5.33	<0.001	3.21 ~ 4.25
Innovation environment and pressure	24.00 (23.00,25.00)	28.00 (26.00,28.00)	3.00 (2.00 ~ 5.00)	−5.19	<0.001	2.85 ~ 4.01
Innovative products	13.00 (9.00,16.50)	16.00 (10.50,20.00)	2.00 (2.00 ~ 4.00)	−5.20	<0.001	2.11 ~ 2.98
Total score of innovation ability	140.00 (128.00,147.00)	155.00 (141.00,162.50)	13.00 (12.00 ~ 16.00)	−5.32	<0.001	12.79 ~ 15.05

Note: △Score: Change between baseline and follow-up.

Abbreviation: IQR, interquartile range.

practice, courses, participants could give full play to their subjective initiatives to identify problems in nursing practice and use creative thinking strategies to create prototypes of the devices they envisioned with the help of the workshop members. Specifically, the workshop in this study adopted diverse training methods, such as participatory methods and case discussions, to encourage team members to actively participate in thinking and discussing questions to promote the participants' learning and cultivate innovative thinking. Moreover, a WeChat group was used to enhance trust, a spirit of inquiry, improve the value for learning and provide resource support for innovativeness and experimentation to further enrich the innovative and resourceful atmosphere. Finally, we identified four group leaders with rich innovation experience to guide the members in conducting research on the transformation of clinical problems into innovative topics, which helped to improve the participants' familiarity with the innovation process and their innovative thinking and spirit, thereby improving nurses' innovation practice and research thinking without practical training guidance and enhancing nurses' confidence and practical ability in nursing innovation and research.

Another interesting finding of this study was that 40.6% of the head nurses participated in this training, which was consistent with findings by Chen et al., (2019). Although some foreign nursing schools have attempted to establish "nursing innovation" to combine nursing professional education with innovation (Clark & Webster, 2012; Yonge et al., 2012), innovation in nursing education in China is still in the initial state (Jiang et al., 2017). Key nursing staff members, such as nurse leaders, were the main participants in the innovation ability training programme, indicating that nursing leaders attached great importance to nursing innovation to help themselves learn to be more creative (Snow, 2019; Stilgenbauer & Fitzpartick, 2019; White et al., 2016). As the heads of nursing management and promoters of nursing tasks, key nursing staff had excellent theoretical knowledge and professional skills and were responsible for nursing quality and nursing safety. Many key nursing staff had a highly professional sense of mission, high levels of job involvement and successful innovation through on-the-job innovation training. Additionally, the nurse leader participants in this study could provide good examples to inspire creativity and could provide education to empower staff to use creative thinking techniques to solve problems in practice (Joseph, 2015; Lv et al., 2018; Noles et al., 2019; Snow, 2019).

Since this study was to conduct a nursing innovation workshop in one district hospital, the research scheme had high feasibility and operability and was popular with the participants, although it had some limitations. First, only one hospital was included, and the sample size was small, which could increase the risk of selection bias. Second, the design was quasi-experimental; therefore, the results cannot be entirely attributed to the effect of the interventions since the entire design lacked a control group. Thus, this outcome evaluation will benefit substantially if complemented with good qualitative findings. Moreover, this study requires further verification in more hospitals and among more nurses.

TABLE 4 Clinical nurses' scientific research abilities at baseline and follow-up with change over time in the group (N = 37)

Measurement factors	Baseline	Follow-up	△Score			
			Median score (IQR)	Z value	P value	95% CI range
Ability to generate research ideas	6.00 (4.50 ~ 7.00)	9.00 (6.50 ~ 9.00)	2.00 (1.00 ~ 3.00)	−5.19	<0.001	1.57 ~ 2.32
Ability to search and review literature	8.00 (7.00 ~ 10.00)	12.00 (9.00 ~ 15.00)	3.00 (2.00 ~ 5.00)	−5.11	<0.001	2.83 ~ 4.42
Ability to design research protocol	7.00 (4.50 ~ 9.50)	9.00 (5.00 ~ 13.00)	3.00 (1.50 ~ 4.00)	−4.49	<0.001	1.98 ~ 3.53
Ability to conduct research	8.00 (5.00 ~ 11.00)	12.00 (8.50 ~ 12.50)	3.00 (2.00 ~ 5.00)	−5.26	<0.001	2.65 ~ 3.84
Ability to analyse research data and material	5.00 (2.50 ~ 7.00)	6.00 (5.00 ~ 10.00)	2.00 (1.00 ~ 4.00)	−4.81	<0.001	1.84 ~ 3.08
Ability to write a research report	9.00 (6.50 ~ 12.00)	12.00 (8.50 ~ 14.50)	3.00 (2.00 ~ 5.00)	−4.89	<0.001	2.35 ~ 3.97
Total score of scientific research ability	42.00 (31.50 ~ 54.50)	60.00 (48.50 ~ 72.00)	15.00 (11.00 ~ 21.00)	−5.31	<0.001	14.39 ~ 19.99

Note: △Score: Change between baseline and follow-up.

Abbreviation: IQR, interquartile range.

7 | CONCLUSIONS

The present results indicate that innovation workshops with theoretical and practice trainings combined can improve nurses' innovation and research abilities. Nurses with senior experience involved in workshops could serve as leading roles, while the usage of social media such as WeChat could facilitate training. However, further interventions designed as randomized control trials with larger groups from different levels of hospitals would be useful to confirm the present findings of the effect of nursing innovation workshops on the cultivation of nurses' innovation abilities.

CONSENT FOR PUBLICATION

Not applicable.

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CONFLICT OF INTEREST

No conflicts of interest have been declared by the authors.

AUTHOR'S CONTRIBUTIONS

LG: Conceptualization, Methodology, Writing-Original Draft preparation. QL: Conceptualization. XH: Data Curation, Software, Investigation. JO: Funding acquisition, Data Curation. MW: Conceptualization, Methodology, Investigation, Writing-Reviewing and Editing. Statement: All authors have read and approved the manuscript.

ETHICAL APPROVAL

This study was approved by the Ethics Committee of the People's Hospital of Nanhai District, Foshan, Guangdong (Ethical review number: 2019015). We explained the purpose and procedure to each participant, and they were free to withdraw from the study at any time. We obtained written consents from all participants before enrolment.

DATA AVAILABILITY STATEMENT

The data of our manuscript can be obtained by email to the first author for legitimate reasons.

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