Effect of Self-Learning Module on Nurses' Performance Regarding Care of Patient Undergoing Permanent Pacemaker

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Abstract

Background: The self-learning module is necessary for helping nurses adapt to the requirements of the current healthcare system. **Aim:** The study aimed to evaluate the effect of self-learning module on nurses' performance regarding care of patient undergoing permanent pacemaker. **Setting:** This study was conducted in Cardiac Department, Cardiac Catheterization Unit, and Coronary Care Unit at Benha University Hospital, Qalubia Governorate, Egypt. **Subjects:** The study included a convenient sample of nurses (the total number was 50 nurses), who were subjected to a quasi-experimental research design (pre/ posttest). **Tools of data collection:** Two tools were used**, Tool I:** Nurses self-administered questionnaire to assess the baseline data and consisted of two parts: **Part I:** Demographic characteristics, **Part II:** Nurses' knowledge regarding care of patient undergoing permanent pacemaker. **Tool II**: Nurses' practice observational checklist. **Results:** Found that, prior to the self-learning module intervention, 100 % of studied sample had poor knowledge scores and level pre implementation of self-learning module intervention, however 74%, 66% of studied sample had good knowledge scores and level post one month and follow up respectively of implementation of self-learning module intervention. In terms of total practices score, only 26% of participants showed a satisfactory level of practice pre the self-learning module intervention. However, post one month of the intervention, 78% of them achieved a satisfactory level of practice, compared to 76% follow-up. **Conclusion:** The knowledge and practice of nurses are positively affected by the application of self-learning module intervention regarding the care of patients undergoing permanent pacemaker placement. **Recommendations:** Nursing educators should adopt the self-learning module as a learning source material that is accessible to staff nurses in clinical contexts, enabling them to learn at their own pace and convenience.

Keywords: Self-learning module, Nurse performance, Permanent pacemaker

Introduction

Cardiovascular rhythm dysfunction is a significant concern in cardiovascular disease. To treat cardiac rhythm disorders, temporary or permanent pacemakers can be implemented to substitute irregular or lethargic strokes with consistent impulses. Bradycardia, which is the consequence of an abnormal cardiac rhythm, induces dyspnea, congestive heart failure, and diminished tissue perfusion. Serious arrhythmias may necessitate immediate medical attention to restore a regular rhythm **(Hamed et al., 2023).**

A pacemaker is an electronic device that helps regulate irregular heart rhythm and can be used to start the heartbeat when the heart's intrinsic electrical system is unable to produce a rate that supports cardiac output. Both temporary and permanent pacemakers are possible. Patients are supported by a temporary pacemaker until they recover

enough to receive a permanent one **(Lynn, 2020).**

The pacemaker itself is made up of two parts: wire leads that link the generator to the heart and a pulse generator. A lithium-based battery and the circuitry necessary to recognize, evaluate, and generate the output of the heart rhythm make up the pulse generator. Depending on the programming, the battery can last over ten years; toward the end of its life, it slows down gradually rather than dropping off suddenly **(Abraham et al., 2021)**.

Additionally, it is implanted to reduce symptoms and avoid any morbidity or death that may follow from bradycardia. Numerous conditions affecting the sinus node, the atrioventricular (AV) node, the His-Purkinje system, or a combination of these can cause bradycardia. Its symptoms are typically caused by a decrease in heart output. These symptoms include dizziness, congestive heart failure, pre syncope, syncope, weariness, poor exercise tolerance, and dyspnea upon exertion **(Stouffer et al., 2023)**.

Typically, the process of implanting a pacemaker is usually safe. Infection, major bleeding, heart valve perforation, stroke, myocardial infarction (heart attack), lung puncture, and hematoma (blood clot) formation in the skin cavity are all possible complications of any exploratory procedure. Additional factors associated with long-term risks are: Electrode tip fracture, skin pocket erosion, pacemaker electrode laxity, incorrect pacemaker activation, and an unstable pulse generator-pacemaker lead connection are all potential complications **(Curtis, 2020).**

The role of cardiothoracic surgical nurses is essential in preparing patients and the families for surgery. Given that the pacemaker will become an indispensable component of the patient's life, it is imperative to assess the comprehension of the patient and caregiver and to offer additional education. The main goal of this is to make sure that any complications or pacemaker malfunctions are promptly and efficiently handled **(Angelidou, 2019).**

Prior to the implantation of the pacemaker, the nurse guarantees that the patient undertakes a sequence of diagnostic tests to determine the cause of the irregular pulse. These assessments may encompass an electrocardiogram, holter monitoring, echocardiogram, stress test, psychological evaluation, and an evaluation of the patient's medical and social history. For instance, due to possible anatomical changes, implantation on the same side of the fractured clavicle may be prohibited if prior clavicle fractures are known **(Mohamed et al., 2020).**

In order to help nurses, meet the demands of the modern healthcare environment, self-learning modules are crucial. In order for nurse educators to help nurses develop the abilities necessary for self-learning modules, they must have a thorough understanding of the concept. To evaluate the student's development, teachers use self-learning modules (SLMs), which are courses of study that are designed to be completed alone **(Mohamed & Ibrahim, 2021).**

Whether students use print or digital self-paced learning modules, competency-based education will benefit them all. These modules are organized sets of instructions that assist students in acquiring a specific corpus of knowledge or skill. When students use multiple modules, they can learn a complex process or body of knowledge. In addition to supplementing conventional instruction to offer more comprehensive and/or additional training, self-learning modules serve a variety of purposes, such as facilitating learning for individualized or self-paced instruction **(Mohamed & Ibrahim, 2021).**

Significance of the study:

Even with a successful pacemaker installation, patients may still experience physical, psychological, social, and spiritual problems; yet, the treatment is lifesaving and restores patients to full productivity and enhanced health. The number of pacemakers in the globe is approximately 3 million, with 600,000 being implanted each year. Managing this constantly expanding patient population poses a challenge to all healthcare professionals, whether they are in the operating room, primary care practice, or cardiology ward **(Abdel Monem et al., 2022).**

Benha University Hospital's manual statistical records show that the number of patients of undergoing permanent pacemaker was (270) cases in the last year (2024) **(Benha Annual Statistical Records, 2020).** In order to maintain their expertise and play a part in bettering patients' health, nurses understand the significance of continuing their education throughout their careers **(Mohamed & Ibrahim. 2021)**. As a result, self-learning is that which does not rely on a teacher. It puts the student first. Creating a self-study module to help nurses' better care for patients with pacemakers was the driving force behind this research. The learner is ultimately responsible for his own learning; he decides what, when, where, and how to learn.

Aim of the Study:

The study aimed to evaluate the effect of self-learning module on nurses' performance regarding care of patients undergoing permanent pacemaker.

Research hypotheses

The following research hypotheses were formulated to achieve the aim of this study:

H (1): Nurses' knowledge score regarding care of patients' undergoing permanent pacemaker could be significantly improved after implementing the self-learning module than before**.**

H (2): Nurses' practices score regarding care of patients' undergoing permanent pacemaker could be significantly improved after implementing the self-learning module than before.

H (3): There could be a significant positive correlation between nurses' knowledge and practice post implementing self-learning module.

Subjects and method

Research design:

This study employed a quasi-experimental design. The influence of a continuing program on one or more output or outcome indicators can be evaluated using a quasi-experiment, which compares results across time and has two characteristics before and after (pretest-posttest) **(White & Sabarwal, 2014).**

Setting:

This study was carried out at Benha University Hospital at Cardiac Department, Coronary Care Unit and Cardiac Catheterization Unit. In the third floor the Cardiac Department and Coronary Care Unit (CCU) are located which has eight beds also, three rooms are located next to it; two of them have six beds each, while the third has four. Two surgical rooms and nine beds make up the ground floor's Cardiac Catheterization Unit.

Subjects:

A convenient sample of fifty nurses (twenty from cardiac department, twenty from cardiac catheterization unit and ten from the coronary care unit) at Benha University Hospital who offer nursing care to patients getting permanent pacemakers; the nurse's range in age, gender, education level, and

years of experience.

Tools of Data Collection:

Data was collected by using the following 2 tools:

Tool 1: Nurses' self-administered questionnaire:

A literature review was conducted to substantiate it **(Mohamed et al., 2020; Bayomi, 2020 & Elsebai et al., 2022)**. Composed in an uncomplicated Arabic language, it was intended to assess the level of knowledge that nurses possess regarding the care of patients with permanent pacemakers.

It consists of two main parts:

Part (1): Personal data of the studied nurses: It included five questions of queries regarding the personal characteristics of the study subjects which are age, sex, degree of education, number of years of experience, and number of training courses attended by nurses on how to care for patients with permanent pacemakers.

Part (2): Nurses' knowledge regarding care of patient undergoing permanent pacemaker: The test included 51 multiple-choice questions, with each question carrying a single point. The questions were categorized as follows: cardiac anatomy and physiology; pacemaker knowledge (including definition, indications, complications, and symptoms of pacemaker malfunction); nursing care before, during, and after permanent pacemaker implantation; precautions to maintain the pacemaker; medication; and follow-up.

Scoring system

We calculated the total score for the questionnaire, which was 51 scores (100 percent), based on the knowledge that the nurses provided. Each question had a score from 0 to 1, with 1 score for the correct answer and 0 for the incorrect one.

The total score for knowledge was (51) degree and was categorized as follows:

- For 75-100% was considered good level of knowledge (38-51 degree).
- For 60- >75% was considered average level of knowledge (38- 30> degree).
- For less than 60% was considered poor level of knowledge (>30 degree)

Tool II: Nurses' practice observational checklist:

This tool was developed by the researchers after reviewing the related and recent literatures **(Jacob et al., 2015; Perry & Potter, 2017)** and modified by the researchers after review of related literature. When administering care to patients who have a permanent pacemaker, it monitored the nurses' performance. The four primary areas of practice comprised 84 steps: care for a permanent pacemaker (with 15 steps for preparation and 9 steps for post-implantation), care for wounds (17 steps), measurement of radial pulse (13 steps), and electrocardiogram (30 steps).

Scoring system

Each step that was done correctly was given a score of 1, while any steps that were either not done at all or were done incorrectly were given a score of 0. A total of eighty-four points were awarded for the checklist.

The total practice score level was categorized as follows:

- Satisfactory level of practice was considered as 80% or higher ($\geq$ 68 degree).
- Unsatisfactory level of practice was considered as less than 80% (< 86 degree**).**

Validity & Reliability of tools

Five medical-surgical nursing department faculty members of Benha University evaluate tools. Regarding most of the questions on the observational checklist, experts agreed in line with the nurses' self-

administered questionnaire. The self-learning module was revised by the same experts, who established a consensus and made modifications in accordance with the panel's assessment of the content's appropriateness, completeness, and sentence clarity, based on the current literature.

The reliability analysis using Cronbach's alpha was carried out to assess the suggested instruments. A reliability of 0.927 was determined for the self-administered questionnaire by the nurses, while a reliability of 0.985 was determined for the observational checklist.

Ethical Consideration

Following ethical considerations were assessed at each phase of the investigation: Before the self-learning module was implemented, the investigation was authorized. The study's execution was also authorized by the Ethics Committee of the Faculty of Nursing **(Code: REC-MSN-P84**). Every nurse was informed of the study's goals and objectives, and the researchers took care to protect their anonymity and confidentiality. The nurses were given the assurance that their data would be used exclusively for the study, and they were given the freedom to withdraw from the research at any moment without needing to provide a reason.

Pilot study

For the five nurses who did not participate in the main study, a pilot study was carried out to determine the clarity, applicability, feasibility, and time required to complete each study instrument. The pilot study's findings informed the revisions made to the study tools, so subjects included in pilot study were excluded from the study.

Field Work

Assessment, planning, implementation, and evaluation were the four stages of the study's six-month data collection period, which began in July 2024 to the ended of December 2024.

Assessment Phase:

The researchers collected data at the Cardiac Department, Coronary Care Unit and Cardiac Catheterization Unit on a bi-weekly basis during the morning and afternoon rounds. They interviewed the nurses who worked there, introduced themselves to start a conversation, explained the study's goals, and got verbal and written consent to participate before collecting data. The researchers used a questionnaire and an observational checklist to get the nurses' knowledge and practices when it came to caring for patients with permanent pacemakers.

Firstly: Researchers observed nurses during their morning and afternoon duties for six hours each day. Three times each nurse was watched; the mean was then calculated. The researchers evaluated the practice of nurses during patient care in the field after they completed an observational checklist (tool II) through direct observation prior to the implementation of SLM (pre-test).

Approximately 15-30 minutes were required to complete each criterion on average.

Secondly: The researchers described the questionnaires (tool I), gave them to each nurse individually, and asked them to evaluate their knowledge of how to care for patients with permanent pacemakers. Each nurse needed about fifteen to thirty minutes to complete the questionnaires. The pretests, which tested both knowledge and practice, lasted for two months.

Planning Phase: (Self-learning module development).

Based on a needs assessment with nurses, a literature review **Mohammed et al., 2020**; **Ahmed et al., 2021; Beny, 2021),** researchers' experience, and expert opinions, researchers created a self-learning module.

The researchers created a mobile video series and an Arabic-language booklet that cover both the theoretical and practical aspects of caring for patients with permanent pacemakers.

- **The theoretical part included**: knowledge of the nursing care management of patients with pacemakers, precautions to maintain the pacemaker, medication, and follow-up, definition of pacemaker, component, types, complications, and information about the anatomy and physiology of the heart.
- **The practical part included**: the procedures regarding permanent pacemaker management including preparation, post implantation care, wound care, measuring radial pulse and electrocardiogram.

Implementation Phase:

The nurses were provided with a brief explanation of how to operate the self-learning module, which consists of a booklet and mobile videos. To address some of the challenges that the nurses encountered while working with the SLM, interviews were conducted over the phone with them in the aforementioned setting.

Evaluation phase:

The knowledge and practice are impact of SLM of nurses was assessed after one month of module implementation and again after the third month using the same tools.

Statistical analysis

Using SPSS version (20) organization, coding, computerization, tabulation, and data analysis were conducted. Descriptive statistics were used to display the data as percentages and frequencies. In order to find correlations, we used the chi-square test (X) on qualitative variables. The relationship between quantity data was evaluated using the correlation coefficient (r). The following is our assessment of the significance of the data:

- Insignificant (P value > 0.05).
- Significant (P-value ≤ 0.05).
- Highly significant (P value < 0.001).

Results

Table (1): Exposes that, 50 % of the studied nurses were in the age category 30-40 years, 68 % were females. In relation to educational level, 76% had technical nursing institute. According to at the years of experience, 88% had between one and ten years, while 72% hadn't taken any classes on permanent pacemaker training.

Table (2): Shows mean score, standard deviation, and significant difference of the studied nurses. Statistical analysis revealed there was a statistically significant difference into nurse's knowledge of several topics such as anatomy and physiology, pacemakers, pre- and post-operative preparation, pacemaker precautions, and medication pre, post 1 month, and 3 months of implementing self-learning module intervention where P ≤ 0.001.

Table (3): This table elucidates that there was statistically significant difference regarding to total mean score of nurses knowledge throughout different study periods at P ≤ 0.00.Where, the total mean was (**22.18±3.92**) at pre implementation of self-learning module intervention which changed to (**40.46±13.20**) post one month and slightly decline to (**36.84±19.58**) during follow up.

Figure (1): proves that (100 %) of studied sample have poor knowledge scores and level pre implementation of self-learning module intervention, however 74%, 66% of studied sample have good knowledge scores and level after 1 month and follow up respectively of implementation of self-learning module intervention.

Table (4): It illustrated that there was statistically significant difference into nurse's practices (Permanent pacemaker care, Wound care, measuring radial pulse, electrocardiogram) between pre, post 1 month, and 3 months of implementing self-learning module intervention where $P \leq 0.001$.

Figure (2): proves that 74 % of studied sample have unsatisfactory practice level pre implementation of self-learning module intervention, however 78% and 76% of studied sample have satisfactory level after 1 month and 3 months of implementation.

Table (5): With a significance level of $p < 0.05$, the results imply a statistically significant positive link between the total knowledge of nurses and their practice at the pre-, after 1 month and 3 months of the self-learning module intervention.

Table (6): The self-learning module intervention had a statistically significant correlation with nurses' knowledge at the pre-, after 1 month and 3 months ($p < 0.05$) with respect to age, sex, and experience. However, there was no statistically significant relation with educational level.

Table (7): Age, sex, and experience were statistically significantly correlated with nurses' practice at the pre-, after 1 month and 3 months of the self-learning module intervention ($p < 0.05$). However, there was no statistically significant relation with educational level.

Table (1): Number and percentage distribution of the studied nurses according to their personal data (N=50).

	No	Percent
Age		
❖ 18<30	22	44
❖ 30<40	25	50
❖ 40<50	3	6
❖ >50	--	--
Sex		
❖ Male	16	32
❖ Female	34	68
Educational level		
❖ Diplomat	10	20
❖ A technical nursing institute	38	76
❖ A bachelor's degree in nursing	2	4
Experience		
❖ <5 years	22	44
❖ 5<10	22	44
❖ >10	6	12
Attend training course		
❖ Yes	14	28
❖ No	36	72
If yes Type		
❖ Training	6	12
❖ Conference	2	4
❖ Workshop	6	12

Table (2): Standard deviation, mean score, and significant difference of the studied nurses according to their knowledge pre, post one month and follow-up of self-learning module intervention (N=50).

	Pre test	Post	Follow up	Paird t test pre vs post / p value	Paird t test pre vs follow up / p value
Knowledge about anatomy and physiology	5.08±0.43	6.20±0.42	5.76±0.41	1.45 0.004*	2.96 0.005*
Knowledge about pacemaker	3.10±3.04	6.42±2.77	5.32±3.39	8.90 0.000*	6.44 0.000*
Information about preparation before operation	1.00±1.74	2.98±2.25	2.98±2.25	6.98 0.000*	6.98 0.000*
Knowledge during the procedure	3.48±1.92	3.76±1.93	3.54±2.11	0.559 0.5	0.119 0.906
Knowledge post procedure	4.68±5.06	11.02±4.00	9.82±5.20	5.28 0.000*	3.68 0.001*
Knowledge about pacemaker precaution	2.96±3.16	6.76±2.49	6.34±2.78	4.99 0.000*	4.12 0.000*
Knowledge about medication	1.88±1.76	3.32±1.30	3.08±1.48	6.84 0.000*	6.33 0.000*

(*) Statistically significant at p ≤ 0.05

Table (3): Total knowledge scores and total mean score among the studied sample pre, post one month and follow-up of self-learning module intervention (N=50).

Total knowledge scores	The studied sample (n=50)						Test of significance	
	Pre		Post one month		Follow up		F value For mean	P& (η_p^2)
	No	%	no	%	no	%		
							34.99	0.942
Poor level	50	100	10	20	15	30		
Average level	--	--	3	6	2	4		
Good level		----	37	74	33	66		
Range **Mean ± SD**	**16** **22.18±3.92**		**43** **40.46±13.20**		**51** **36.84±19.58**			
T-test	**Pre Vs. post one month**			**Pre Vs. Follow-up**			**0.000***	
	8.42			4.75				
P-Value	0.000*			0.000*				

F: repeated measure ANOVA, (*) Statistically significant at p ≤ 0.05, mean, SD: standard deviation, (ηp2): partial eta-squared, T- test.

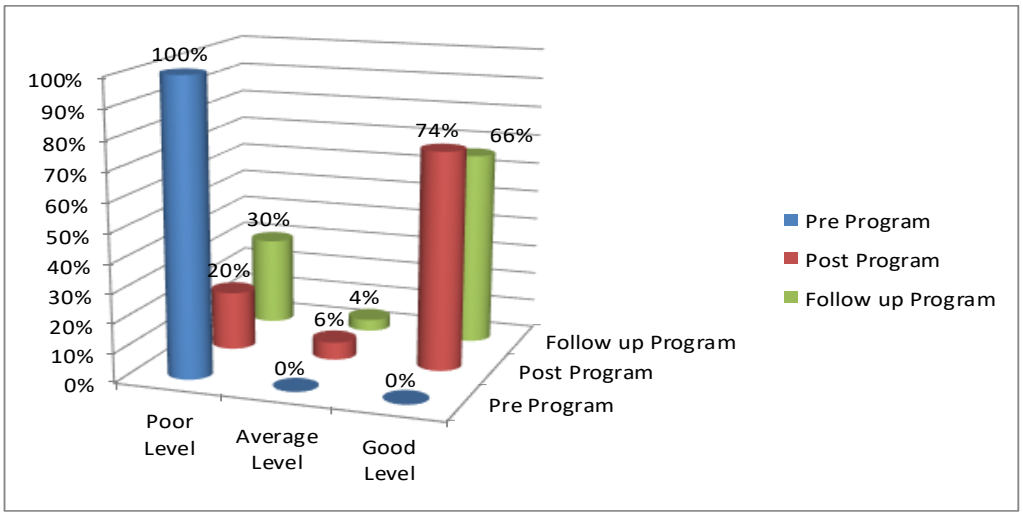

Figure (1): Percentage of total knowledge scores and level among the studied sample pre, post one month and follow-up of self-learning module intervention (N=50).

Table (4): Mean score, standard deviation, and significant difference of the studied nurses according to their practices pre, post one month and follow-up of self-learning module intervention (N=50).

	Pre test	Post	Follow up	Paird t test pre vs post / p value	Paird t test pre vs follow up / p value
Permanent pacemaker care	11.20±11.00	19.06±7.65	17.16±8.91	3.14 0.003*	2.22 0.031*
Wound care	7.74±4.42	14.04±5.47	12.40±5.87	7.62 0.000*	5.44 0.000*
Measuring radial pulse	5.02±4.60	10.28±4.30	10.60±3.75	4.22 0.000*	4.78 0.000*
Electrocardiogram	12.68±0.62	23.72±1.44	24.04±1.39	6.31 0.000*	6.63 0.000*

(*) Statistically significant at p ≤ 0.05

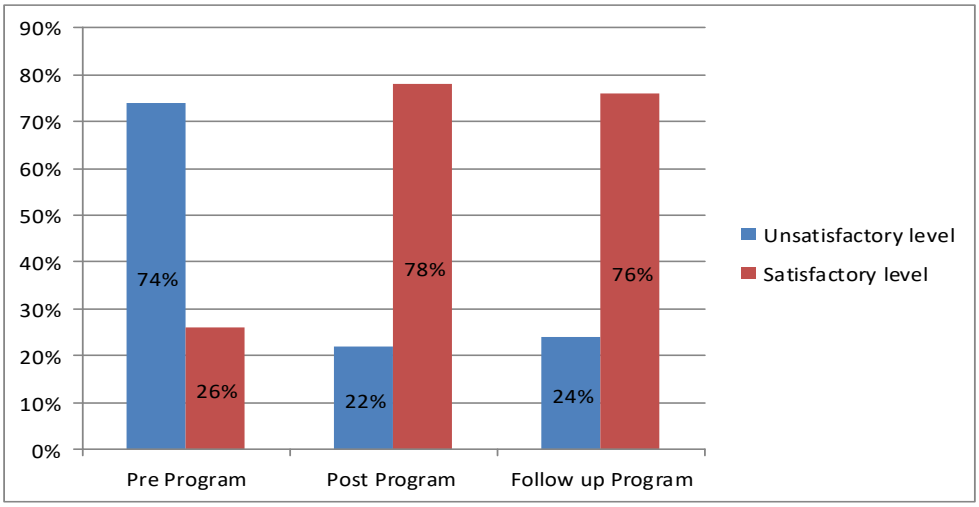

Figure (2): Percentage of total practices scores and level among the studied sample pre, post one month and follow-up post implementation of the program (N=50).

Table (5): Correlation between total nurses' knowledge and their practice at pre, post one month and follow-up of self-learning module intervention (N=50).

Variable	Knowledge		Practices	
	r	P	r	P
Knowledge				
❖ Pre	--	--	0.736	0.000*
❖ Post	--	--	0.975	0.000*
❖ Follow-up	--	--	0.985	0.000*

(*) Statistically significant at p ≤ 0.05

Table (6): Relation between total nurses' knowledge and their personal data at pre, post one month and follow-up of self-learning module intervention (N=50).

	Pre program				Post program				Follow up program			
	Poor	Average	Good	χ^2 1 Pvalue	Poor	Average	good	$\chi^2$2 Pvalue	Poor	Average	good	$\chi^2$3 Pvalue
	%	%	%		%	%	%		%	%	%	
Age in years												
❖ **18<30**	100			A	0	0	100	22.69	0	0	100	23.86
❖ **30<40**	100				28	12	60	0.000*	48	8	44	0.000*
❖ **40<50**	100				100	0	0		100	0	0	
Sex												
❖ **Male**	100			A	0	0	100	8.26	0	0	100	12.12
❖ **Female**	100				29.4	8.8	61.8	0.016*	44.1	5.9	50	0.002*
Educational level												
❖ **Diploma**	100			A	0	0	100	5.33	0	0	100	6.69
❖ **Institute**	100				23.7	7.9	68.4	0.225	36.8	5.3	57.9	0.153
❖ **Bachalourous**	100				50	0	50		50	0	50	
Experience												
❖ **<5 years**	100			A	0	0	100	26.93	0	0	100	28.48
❖ **5<10**	100				27.3	4.5	68.2	0.000*	40.9	9.1	50	0.000*
❖ **>10**	100				66.7	33.3	0		100	0	0	
Attend training course												
❖ **Yes**	100			A	28.6	21.4	50	9.94	64.3	14.3	21.4	18.61
❖ **No**	100				16.7	0	83.3	0.007*	16.7	0	83.3	0.000*

(*) Statistically significant at p ≤ 0.05

Table (7): Relation between total nurses' practice and their personal data at pre, post one month and follow-up of self-learning module intervention (N=50).

	Pre program		χ^2_1 P value	Post program		χ^2_2 P value	Follow up program		χ^2_3 P value
	Unsatisfactory	Satisfactory		Unsatisfactory	Satisfactory		Unsatisfactory	Satisfactory	
	%	%		%	%		%	%	
Age									
❖ **18<30**	100	0	18.81	0	100	18.29	0	100	18.42
❖ **30<40**	60	40	0.000*	32	68	0.000*	36	64	0.000*
❖ **40<50**	0	100		100	0		100	0	
Sex									
❖ **Male**	100	0	8.26	0	100	6.63	0	100	7.43
❖ **Female**	61.8	38.2	0.004*	32.4	67.6	0.010*	35.3	64.7	0.006*
Educational level									
❖ **Diploma**	100	0	4.72	0	100	4.14	0	100	4.40
❖ **Institute**	68.4	31.6	0.09	26.3	73.7	0.126	28.9	71.1	0.110
❖ **Bachalourous**	50	50		50	50		50	50	
Experience									
<5 years	100	0	25.19	0	100	19.71	0	100	26.07
5<10	68.2	31.8	0.000*	27.3	72.7	0.000*	27.3	72.7	0.000*
>10	0	100		83.3	16.7		100	0	
Attend training course									
❖ **Yes**	50	50	5.82	35.7	64.3	2.13	42.9	57.1	3.79
❖ **No**	83.3	16.7	0.016*	16.7	83.3	0.144	16.7	83.3	0.05

(*) Statistically significant at p ≤ 0.05

Discussion

In order to keep the heart beating at a regular rhythm, a small device called a permanent pacemaker (PPM) is implanted under the skin of the chest. PPMs consist of a battery-powered pacemaker and leads that attach to the heart. During the preoperative and postoperative phases of a patient's care, nurses play essential role **Hamed et al. (2023)**.

The purpose of this research was to determine the effect of self-learning module on nurses' performance regarding care of patient undergoing permanent pacemaker. There are five primary sections to the current study's discussion: first, the personal data of the nurses who participated in the study; second part was nurses' knowledge regarding care of patient undergoing permanent pacemaker pre / post 1 month and 3 months follow up of self -learning module, third part was nurses' practices regarding care of patient undergoing permanent pacemaker pre / post 1 month and 3 months follow up of self-learning module, fourth part discuss the correlation between total knowledge and total practice pre / post 1 month and 3 months of self -learning module intervention. finally fifth part discuss relation between personal data of nurses and their knowledge and practice .

In terms of the personal data of studied nurses, the results of this study showed that almost fifty percent of the nurses within the study were between the ages of 18 and 30. According to the researcher, this might be because young women represent the majority of nurses who deal directly with patients in the nursing field in their study, whereas "senior nurses" are older and handle administrative duties.

This result is consistent with a study by **Mohamed et al. (2020)** titled "Nurses' Performance Regarding Patient with Permanent Pacemaker in Intensive Care Unit," which found that almost two-thirds of the nurses in the study were between the ages of 18 and 25.

On the other hand, this finding is at contrast with **Bayomi's (2020)** study, "Permanent Pacemaker Implantation: Effect of Intervention Protocol on Nurse's Knowledge, Practices, and Patient's Outcomes," which found that almost half of the study population was between the ages of 23 and 47.

Regarding gender, the study's findings showed that over two-thirds of the nurses were female. From the perspective of the researcher, this finding could be explained by the fact that, in Egypt, women account for the majority of nurses and are still outnumbered by men in the nursing field.

Similar to this, **Elsebai et al. (2022)** found that most of the samples they studied were female. Their study was named "Effectiveness of an Educational Program for Management of Patients Undergoing Permanent Pacemaker on Nurses' Performance."

According to years of experience and qualifications, the current survey showed that almost three-quarters of the sample had attended a nursing technical institute. A large portion of Egypt's nursing workforce may have graduated from nursing technical institutes, which could be the cause of this. This may be because half of the nurses in the study were between the ages of 18 and 30. As a result, more nurses graduated from nursing technical institute schools than those with

bachelor's degrees, and over one-third of them had five to ten years of nursing experience.

Similar to this, **Bakr et al. (2020)** found that a significant portion of the nurses in their study had five to less than ten years of experience. Their study was titled "Assessment of Nurses' Performance Regarding Care of Patients Undergoing Cardiac Catheterization in Port Said."

According to the current study, less than three-quarters of nurses had never attended any prior pacemaker training courses. This could be because some nurses lack the motivation and capacity to attend training courses because of a shortage of nurses; an increase in workload may also leave nurses with little time to attend training courses.

Similarly, **Mohammed et al. (2020)** found that the majority of nurses in their study, "Nurses' Performance Regarding Patient with Permanent Pacemaker in Intensive Care Unit," did not receive training on how to care for patients who had permanent pace.

In the second part of this discussion regarding nurses' knowledge related to undergoing permanent pacemaker pre /post and follow up self -learning module. In accordance to the present research , all of the studied nurses had poor knowledge level pre SLM intervention, however, most of them had good knowledge level post SLM intervention, but after three months follow up, there was slight decline in these results.

This outcome could be because the majority of nurses had not taken any training courses pertaining to permanent pacemakers, and over three-quarters of the sample had attended nursing technical institutes. Their knowledge from their school years may not be adequate for such a specialized service.

This finding is consistent with **Elgazzar's (2021)** study, "Efficacy of an Intervention Protocol on Nurse's Knowledge, Practices regarding Permanent Pacemaker Patient's Care," which found that nurses' knowledge of pacemaker care significantly improved following the implementation of the intervention protocol as compared to pre to the intervention, but that there was no significant change in the overall knowledge score.

Additionally, **Ahmed et al.'s (2021)** study, "Nurses Role Regarding the Care of Patients with Permanent Pacemaker," indicated that most nurses in the study knew too little about permanent pacemakers.

As regard to total nurses' knowledge related to care of patient undergoing permanent pacemaker pre /post and follow up self -learning module. The first research hypothesis is supported by the current study's findings, which showed a highly statistically significant improvement in nurses' knowledge about caring for patients undergoing permanent pacemaker during the pre and post-test and follow-up.

Additionally, these results showed that nurses needed to renew and update their knowledge, and that the SLM was successful in improving nurses' understanding of how to care for patients receiving permanent pacemakers.

This is in accordance with the findings of **Mohamed et al. (2022)**, whose study "Impact of Nursing Teaching Protocol on Reduction of Complications for Patient with Permanent Artificial Pacemaker" showed that nurses who had taken part in a self-learning module had

significantly higher mean knowledge scores than those who had not.

The third part of discussion was of the debate focused on the practices of all nurses concerning the pre/post care of patients receiving permanent pacemaker implantation and the follow-up self-learning module. The second research hypothesis is supported by the current study's findings, which showed a statistically significant change in nurses' practices regarding the care of patients receiving permanent pacemakers between the pre and post-test. This suggests that in order to improve their performance level, nurses require continuous instruction.

This led to a consensus with **Beny (2021)**, who carried out a study titled "Effectiveness of Pacemaker Care Protocol on Knowledge and Skill Regarding Care of Client Undergoing Pacemaker Implantation among Nurses at Selected Hospitals." Beny explained that the study sample's overall pre-practice score improved statistically significantly following the installation of the pacemaker care protocol.

The current study revealed that fewer than three quarters of the nurses in the sample had unsatisfactory level pacemaker practice, based on the total practices scores and level among the pre-self-learning module. This result is consistent with that of **Ahmed et al. (2021)**, who discovered that the majority of nurses in the study had inadequate practice levels when it came to caring for patients who had permanent pacemakers.

In terms of overall practice scores and level, the results of this study showed that over three-quarters of the sample under study had satisfactory level practice with pacemakers after completing the self-learning module. According to **Ahmed (2018)**, the majority of nurses in this study have an adequate level of practice with permanent pacemakers. This study supports his findings.

Regarding the fourth section of the discussion, which examined the correlation coefficient between total knowledge and total practice during the post-learning module intervention and the follow-up, the current study found a significant relationship between the total nurse's knowledge score and the total practice score pre, post, and follow up the self-learning module was implemented.

This result suggests that the self-learning module was a successful intervention that enhanced nurses' knowledge and, consequently, their practice. This outcome confirmed the third hypothesis, which postulated a strong positive relationship between nurses' practice and knowledge following the use of a self-learning module.

The current study's findings are consistent with those of **Malk et al. (2018)**, who carried out a study titled "Effect of an Education Program on Nurses Performance Regarding Electrocardiography" and found a positive correlation between the implementation of the follow-up program and the total nurses' knowledge and practice at post. This indicates that nurses' practice in caring for patients with permanent pacemakers is impacted by their lack of understanding.

In relation to fifth part which discuss relation between personal data of studied nurses and their knowledge and practice. Show, a statistically significant relation was found in the current study between the personal data (age, sex, experience, and training course attended) and the knowledge

of nurses both pre and post the self-learning module was implemented.

Although **Mohammed et al. (2020)** did not find a statistically significant correlation between nurses' knowledge and their gender, years of experience, or attendance at training courses, the current study did

The results of the current study showed a statistically significant relationship between nurses' practice pre, post, and follow up the implementation of a self-learning module and personal data (age, sex, and experiences).

This was in agreement with **Mohammed and Atiyah (2018)**, who found a statistically significant correlation between nurses' practice and demographic traits in their study "Nurses, Knowledge Concerning an Implantation Pacemaker for Adult Patients with Cardiac Rhythm Disorder at Al-Nassirrhyia Heart Center.

Conclusion

The majority of studied nurses had poor knowledge and unsatisfactory practices before self- learning module intervention, while they had good knowledge and satisfactory practices post self-learning module intervention. Also, there is a significant positive correlation between nurses' knowledge and practice post implementing self- learning module.

Recommendations

Based on the findings of the present study, the following recommendations can be suggested:

- Self -learning modules (SLMs) should be used by nurse educators as a learning source material available to staff nurses in clinical settings for learning at their own time and pace.
- Build flexibility and create awareness among staff nurses about significance of self-directed learning.
- Self -learning modules can be used for a larger population of staff nurses for generalization of the results.

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تأثير نمط التعلم الذاتي على أداء الممرضين فيما يتعلق برعاية المرضى الذين يخضعون لجهاز تنظيم ضربات القلب الدائم

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وحدة التعلم الذاتي ضرورية لمساعدة الممرضات على التكيف مع متطلبات نظام الرعاية الصحية الحالي. الهدف: هدفت الدراسة إلى تقييم تأثير وحدة التعلم الذاتي على أداء الممرضات فيما يتعلق برعاية المرضى الخاضعين لزراعة جهاز تنظيم ضربات القلب الدائم. المكان: أُجريت هذه الدراسة في قسم القلب، ووحدة قسطرة القلب، ووحدة العناية التاجية بمستشفى جامعة بنها، محافظة القليوبية، مصر. العينة: شملت الدراسة عينة ملائمة من الممرضات (إجمالي عددهن ٥٠ ممرضة)، وخضعن لتصميم بحث شبه تجريبي (اختبار قبلي/بعدي). أدوات جمع البيانات: استُخدمت أداتان، الأداة الأولى: استبيان ذاتي من الممرضات لتقييم بيانات خط الأساس. يتكون الاستبيان من جزأين: الجزء الأول: الخصائص الديموغرافية، والجزء الثاني: معرفة الممرضات فيما يتعلق برعاية المرضى الخاضعين لجهاز تنظيم ضربات القلب الدائم. الأداة الثانية: قائمة مراجعة ممارسة الممرضات. النتائج: وُجد أنه قبل تدخل وحدة التعلم الذاتي، كان لدى ١٠٠٪ من العينة المدروسة درجات معرفة ومستوى ضعيف قبل تنفيذ تدخل وحدة التعلم الذاتي، ومع ذلك، فإن ٧٤٪ و٦٦٪ من العينة المدروسة لديهم درجات معرفة ومستوى جيد بعد شهر واحد ومتابعة تنفيذ تدخل وحدة التعلم الذاتي على التوالي. من حيث إجمالي درجات الممارسات، أظهر ٢٦٪ فقط من المشاركين مستوى مرضيًا من الممارسة قبل تدخل وحدة التعلم الذاتي. ومع ذلك، بعد شهر واحد من التدخل، حقق ٧٨٪ منهم مستوى مرضيًا من الممارسة، مقارنة بـ ٧٦٪ بعد المتابعة. الاستنتاج: يتأثر مستوى معارف وممارسة الممرضات إيجابيًا بتطبيق تدخل وحدة التعلم الذاتي فيما يتعلق برعاية المرضى الخاضعين لتركيب جهاز تنظيم ضربات القلب الدائم. التوصيات: ينبغي على مُعلمي التمريض اعتماد وحدة التعلم الذاتي كمصدر تعليمي متاح للممرضات في السياقات السريرية، مما يُمكّنهن من التعلم بالسرعة التي تناسبهن وبما يناسبهن.