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Research Article

The Effect of Mnemonic Learning Strategy on Critical Care Nursing Students' Tracheal Suction Skill Acquisition

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Background. The mnemonic learning method is a systematic approach that helps nursing students memorize new information more effectively, productively, and easily by connecting new information with existing information and exploring unfamiliar information through visual images or combinations of letters and words. While mnemonics can help students remember specific information, it is essential to examine how well they facilitate the transfer of learning to real-world nursing practice. *Aim*. To investigate the effect of the mnemonic learning strategy on critical care nursing students' tracheal suction skill acquisition and learning satisfaction. *Methods*. A quasi-experimental research design was used. A total of 280 second-year nursing students enrolled in critical care and emergency nursing courses were recruited. These students were assigned to study and control groups. The study group used a mnemonic learning strategy to recall the steps involved in the tracheal suction procedure, while the control group used the traditional learning strategy. Two tools were used for data collection: the tracheal suction procedure checklist and learning satisfaction scale. Comparisons between both groups regarding their performance and satisfaction scores were done. *Results*. Performance scores regarding the tracheal suction procedure were significantly higher in the study group than in the control group in the 5^{th}, 6^{th}, and 10^{th} weeks ($P < 0.001$, <0.001, and <0.001). A total of 70.6% of the participants in the study group reported high satisfaction using the mnemonic learning experience. *Conclusion*. Using a mnemonic learning strategy with critical care nursing students was effective. Participants in the study group exhibited improvement in their tracheal suction procedure scores over time. Critical care nursing students reported higher levels of learning satisfaction with the mnemonic learning method than with the traditional method.

1. Introduction

Since the time of ancient Greece, mnemonics have been used as memory boosters and memory enhancers. This term is derived from the word *mnemonikos*, which means "pertaining to memory" [1]. The mnemonic learning method is a systematic approach that helps nursing students memorize new information more effectively, productively, and easily by connecting new information with existing information and exploring unfamiliar information through visual images or combinations of letters and words. As a strategy, the mnemonic approach can enhance the retention of new knowledge while encouraging thinking and reasoning by providing learners with a context with which they are familiar and thus allowing them to build on previous information. This approach offers learners the ability to maintain their short-term and long-term memory using a variety of techniques such as music, names, expressions,

patterns, note structures, images, connections, and anagrams that help them retain or retrieve information in their memory [2–5].

The different types of mnemonics include musical mnemonics such as songs and jingles, name mnemonics, expression mnemonics, pattern mnemonics, song mnemonics, note composition mnemonics, picture mnemonics, linking mnemonics, and spelling mnemonics. Nursing students may find this approach to be beneficial regarding remembering the necessary tasks they must complete until they develop these practices into habits. Certain approaches to mnemonics are commonly used, such as ADPIE (which refers to assessing, diagnosing, planning, implementing, and evaluating) for the nursing process, SAMPLE (which refers to signs and symptoms, allergies, medications, past history, last oral intake, and events leading to the present illness) for the collection of data regarding patients' medical histories, and MONA (which refers to morphine, oxygen, nitroglycerine, and aspirin) for myocardial infarction treatment [6, 7].

The keyword method is the first mnemonic strategy used to help improve learners' memory and improve their early learning and factual recall based on integrated auditory and visual cues. Developing a keyword strategy requires the 3 Rs: reconstructing, relating, and retrieving. Another method is the call-word method, based on the mnemonic implementation of reconstructive elaboration. Yet another method is the peg method, which also focuses on the mnemonic implementation of reconstructive elaboration. Acrostics, acronyms, narratives, and rhymes are examples of mnemonic strategies that help transform abstract materials and concepts into more meaningful and memorable contents. Acrostics are "sentences that are developed to help the person retrieve letters." Acronyms are "words that are developed from the first letter of words that are to be remembered" [8].

The utilization of mnemonics is in line with the stages of memory processing, as originally posited by Craik and Lockhart in 1972. This model emphasizes the extent of cognitive processing involved in memory encoding, positing that memories associated with more profound levels of processing are retained for longer. This approach lacks organization. Its fundamental concept posits that memory primarily arises from the cognitive processes involved in information processing. The way in which information is encoded has an impact on its subsequent recall. The ease of information retention is directly proportional to the depth of processing [9]. The concept of the depth of processing can be understood as a spectrum ranging from shallow to deep. The utilization of deeper levels of analysis results in the generation of more intricate, enduring, and robust memory traces than the use of shallow levels of analysis. Information processing begins in sensory memory, moves to short-term memory, and eventually moves to long-term memory [10] (Figure 1).

Endotracheal suctioning (ETS) is frequently employed by critical care nurses to remove pulmonary secretions in critically ill patients who have artificial airways. This specific technique is of the utmost importance with regard to ensuring that patients' airways remain open, thereby facilitating sufficient oxygenation. The utilization of appropriate methodologies, suitable resources, and broad knowledge helps reduce the probability of procedural complications. The potential problems include hypoxia, hypoxemia, arrhythmia, and infection, as well as hypertension, hypotension, tachycardia, bradycardia, and atelectasis resulting from the activation of the sympathetic and parasympathetic nervous systems [11–13]. Nurses in Egypt have their first experience with ETS while studying for their bachelor's degrees and are expected to be competent and efficient with regard to performing this procedure in the laboratory in an orderly manner without making any errors before engaging with real patients during their clinical experience. Numerous nursing studies have shown that student nurses frequently experience discomfort and anxiety when performing suctioning procedures due to a lack of complete knowledge [12, 14, 15]. Other studies have indicated that nursing students encounter difficulties while attempting to perform this skill, which encompasses multiple phases [11–16].

Clinical education is an essential and integral part of the nursing education program [17]. The mnemonic learning method can help students organize and prepare for patient care, mitigate their anxiety, and enable them to apply what they have learned before actual demonstrations on real patients. Therefore, this study aimed to identify the impacts of the mnemonic learning strategy on critical care nursing students' tracheal suction skill acquisition and learning satisfaction.

1.1. Aim of the Study. The aim of the study is to identify the impacts of the mnemonic learning strategy on critical care nursing students' tracheal suction skill acquisition and learning satisfaction.

1.2. Research Hypotheses

H1: Students who employ the mnemonic learning strategy exhibit higher achievement scores in tracheal suction skill acquisition than students who use the traditional method.

H2: Students who employ the mnemonic learning strategy exhibit higher levels of learning satisfaction than students who use the traditional strategy.

2. Materials and Methods

2.1. Design. A quasi-experimental research design was used to achieve the aims of the current study.

2.2. Setting. This study was conducted at the Faculty of Nursing at Damanhur University in Egypt.

2.3. Subjects. A total sample of 280 second-year nursing students enrolled in a critical care and emergency nursing course was recruited. An optimal sample size of nursing students was calculated using G ∗ power version 3.1.9.7

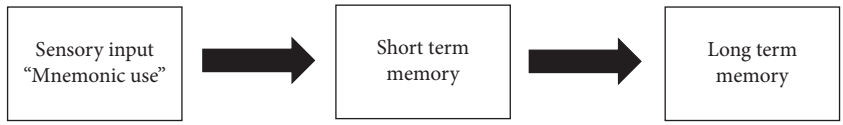

Figure 1: Levels of processing [10].

software with a level of significance of 0.05 and an effect size of 0.80. Their ages ranged from 18 to 19 years old, and they agreed to participate in the current study. These students were randomly assigned to either the study group or the control group (140 nursing students were assigned to each group). Participants in the study group were subjected to the mnemonic learning strategy, while those in the control group used the traditional method (i.e., merely memorizing the corresponding steps during the demonstration of the procedure). Students who refused to participate in the study were excluded.

2.4. Ethical Procedures. The study was conducted according to the guidelines of the Declaration of Helsinki, and the protocol was approved by the Research Ethics Committee, Faculty of Nursing, Damanhour University in Egypt under ethical code no. 59-c. The researchers obtained informed consent from the students by providing them with a detailed explanation of the study's objectives prior to their participation. The participants were fully informed of the voluntary nature of their involvement in the study, with the explicit understanding that they retained the right to withdraw from participation at any point. The study ensured that the confidentiality, privacy, and anonymity of both the students and their responses were maintained throughout all stages of the research.

2.5. Validity and Reliability. A pilot study was conducted to assess the tools' clarity and feasibility on 10% of the nursing students ($N = 30$), who were then excluded from the final sample. Reliabilities of tools 1 and 2 were assessed using Cronbach's alpha coefficient, and the values were 0.97 and 0.92, respectively. The content validity of the tools was assessed by 5 experts in critical care nursing and nursing education, and the necessary modifications were made in accordance with their recommendations. The respective content validity index values were 89.5% and 94.5%, respectively.

2.6. Tools. Two tools were used for data collection. Tool one, i.e., the "tracheal suction procedure checklist," was developed by the researchers based on an extensive review of the relevant literature [18–22]. This tool was used to assess critical care nursing students' skill acquisition regarding tracheal suction. It was divided into 3 sections: before, during, and after the procedure. Each item took a score of 1 point for correct practice and 0 points for unperformed or incorrect practice, following which the averages of the scores were converted to percentages. The scores were classified into 3 categories (<50, which denotes poor performance; 50–75, which indicates average performance; and 76–100, which represents good performance). Tool two, i.e., the learning satisfaction scale, was adapted from [22] and featured 20 questions. Students responded to these questions on a five-point Likert scale ranging from 1 (strongly dissatisfied) to 5 (strongly satisfied). Cut-off points were established for students' levels of satisfaction as follows: scores lower than 65 indicate low learning satisfaction, scores higher than 85 indicate high learning satisfaction, and scores between 65 and 85 denote neutral learning satisfaction. In addition, students' demographic and academic data (age, sex, last year grade, and previous hospital experience) were collected.

2.7. Study Procedures. Data were collected from October 2021 to January 2022. Data collection was conducted in three phases (Figure 2).

2.7.1. Preliminary Phase. During the 1st week, the researcher prepared the content and the students. The researcher developed the content for the tracheal suction procedure by using the letter-phonetic method of the mnemonic learning strategy. Regarding students' preparation, both groups were informed about the objectives of the tracheal suction procedure, in which context the study group employed the mnemonic learning strategy while the control group used the traditional learning strategy. Students of both groups demonstrated the tracheal suction procedure.

2.7.2. Implementation Phase. This phase lasted 6 weeks from the 5th to 10th week. During the 5th week in the laboratory, tracheal suction procedure instruction was provided using the mnemonic learning strategy for the study group, whereas traditional instruction in the same procedure was provided to the control group. Immediately after redemonstrating the procedure, both groups were assessed using the tracheal suction procedure checklist (tool one), and scores were obtained. During the 6th week in the laboratory, both groups performed the same procedure once again. Thereafter, students' scores were collected. During the 10th week in the hospital, both groups repeated the same process in the context of real patients in the hospital. Students' scores were collected after the procedure.

(1) Mnemonic Learning Strategy Applied for the Study Group. The clinical faculty were used the letter-phonetic method used while explaining and demonstrating the tracheal suction procedure for the study group in the critical care nursing skill lab.

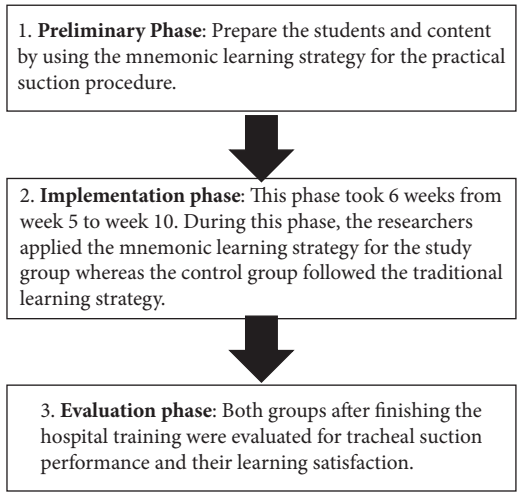

Figure 2: Flowchart of the study.

(2) Preparation Steps before Tracheal Suction Care Using Mnemonic (8 Ps)

Pre-asses the patient using 4 "**S**"
Vital Signs—Secretion presence-Size of ETT-Last meal
Prepare patient.
Prepare Self
Prepare environment.
Procedure explanation.
Position patient.
Perform percussion.
Place tissue paper on the patient's chest.

(3) Tracheal Suction Procedure Steps Using Mnemonic (10 Os + 3 Ns + 1 P + 1 M)

Open negative pressure
Open sterile catheter
Open sterile saline
Open sterile gloves
Obtain sterile Cather on a sterile gloved hand
Open suction tubing with the unsterile gloved hand
lOcked suction catheter to the connecting tube
dOminant hand-handling suction catheter.
O_2 100% deliver
Quick and Gentle catheter insertion
No negative pressure during insertion
No more than 10 seconds
No more than three passes
Monitor patient
Off suction machine
Place tissue paper on the patient's chest

(4) Post Tracheal Suction Care Steps Using Mnemonic (8 Rs)

Reassess the patient's breath sound
Reposition and Reassure the patient
Reconnect mechanical ventilator/O_2 delivery setup
Readjust the oxygen source to preset O_2 concentration
oRal care if needed
Rearrange environment
Remove gloves and wash hands
Report unexpected outcomes O_2 100% deliver

2.7.3. Evaluation Phase. During this phase, an online Microsoft form was sent to all students in both groups after completing the hospital evaluation to assess their learning satisfaction using the learning satisfaction scale (tool two).

2.8. Statistical Analysis of Data. Data were input into the computer and analysed using IBM SPSS software package version 20.0. Qualitative data were described using numbers and percentages. The Kolmogorov–Smirnov test was used to verify the normality of the distribution. Quantitative data are described in terms of means and standard deviations. The significance of the results thus obtained was judged at the 5% level. The chi-square test was used for the categorical variables to facilitate comparison between the groups. Monte Carlo correction was used for the chi-square test when more than 20% of the cells had an expected count less than 5. The Mann–Whitney test was used for abnormally distributed quantitative variables to facilitate

comparison between the two studied groups. The Friedman test was used for abnormally distributed quantitative variables to facilitate comparison across more than two periods.

3. Findings

Table 1 compares the demographic and academic data of participants in the study and control groups. Approximately 67.1% of the control group and 64.3% of the study group were male. Approximately 78.6% of the control group and 82.9% of the study group were aged 20–22. Thirty-five percent of the control group had good grades in the last year, as did 30% of the study group, indicating no significant differences between these groups regarding their grades in the last year ($P = 0.982$). A total of 54.3% of both groups had previous hospital training. No statistically significant differences were observed between the groups in relation to their demographic and academic data.

Table 2 presents a comparison of tracheal suction performance scores at various time intervals between nursing students in the two groups. Statistically significant differences between the two groups were observed in terms of tracheal suction performance in the 5^{th}, 6^{th}, and 10^{th} weeks ($P < 0.001$, $P < 0.001$, $P < 0.001$). Furthermore, it is evident that the performance scores attained by participants in the study group were greater than those obtained by participants in the control group. Furthermore, a statistically significant difference was observed across various time intervals (Fr (p_0) = 23.838, $P < 0.001$; Fr (p_0) = 183.266, $P < 0.001$).

Figure 3 shows a comparison between students' learning satisfaction with the traditional and mnemonic learning strategies. Fewer than half of the participants in the control group (48.1%) reported high satisfaction, whereas nearly two-thirds of participants in the study group (70.6%) reported high satisfaction with the mnemonic learning experience. A statistically significant difference was observed between the two groups in terms of their level of learning satisfaction ($\chi^2 = 24.667$, $P < 0.001$).

4. Discussion

The present study revealed that the mean score (standard deviation) for overall achievement in the tracheal suction process was considerably higher in the study group than in the control group in the 5^{th} week ($U = 4754.0$, $P \leq 0.001$), 6^{th} week ($U = 386.50$, $P \leq 0.001$), and 10^{th} week ($U = 121.50$, $P \leq 0.001$), indicating that using mnemonics as a learning strategy was more effective than using the traditional method of recalling the steps involved in the procedure. A possible reason for this finding could be that mnemonics may facilitate memory retention by conferring meaning, structure, and organization on the material.

The findings of the current study echo the conclusions of Koksal et al., who reported that a mnemonic learning strategy is a supportive method that allows students to more easily recall and retain the required procedural steps in a sequential and easy manner, which leads to reduced stress, thus improving students' cognitive responses and promoting higher-order thinking [23]. Moreover, Bakken reported that using mnemonics as a learning strategy might enhance learning, help alleviate confusion with regard to related concepts, and improve information retention and application over the long term [8].

Mocko et al. reported that students may obtain the advantages they need to combat the anxiety they experience when working on an issue if they are encouraged to study for an exam using mnemonics. The learner may be able to start the task successfully simply by recalling a mnemonic to aid them [24]. Moreover, Page et al. reported that mnemonic memory aids may be helpful to critical care nurses with regard to providing patient education and helping them recall the relevant steps each time. In that study, the nurses under investigation exhibited high scores in terms of their knowledge and skills regarding patient health education [25]. O'Rourke et al. also reported significant improvements in handoff communication and a reduction in handoff failures after using handoff mnemonics among staff nurses [26]. Bobby found that mnemonic techniques are becoming a targeted strategy for improving student performance, retrieving previously learned information, and/or manipulating and storing the information being processed, particularly among students with learning disabilities [27].

Student nurses may feel stressed in clinical learning environments, which represent the location of their first professional practice, and student input helps improve these environments [28]. The level of student satisfaction was measured in the 10^{th} week to collect their satisfaction with learning the tracheal suction procedure using the mnemonic technique. More than half of the participants in the study group reported satisfaction with the mnemonic learning strategy, thereby reporting greater satisfaction than participants in the control group. A reason for this finding could lie in their ability to recall the steps involved in the procedure across separate time intervals, thus increasing their confidence and leading to satisfaction with their performance. These findings are congruent with those of the Hill study, which reported increased enthusiasm and satisfaction on the part of students with regard to using the mnemonic strategy to learn English vocabulary since they enjoyed learning as a result of the faster pace of memorization [29].

4.1. Limitations. One limitation of this study is the absence of random assignment into study and control groups. One potential limitation of the study is the possibility of interaction or sharing of learning tools between the study and control groups. It is challenging to ascertain the extent to which such interactions occurred and their impact on the study results.

Table 1: Comparison of students' demographic and academic data between the study and control groups.

Students' data	Study group ($n = 140$)		Control group ($n = 140$)		Test of sig.	P
	No	%	No	%		
Demographic data						
Gender						
Male	90	64.3	94	67.1	$\chi^2 = 0.254$	0.615
Female	50	35.7	46	32.9		
Age						
<20	6	4.3	10	7.1		
20–22	116	82.9	110	78.6	$\chi^2 = 1.265$	0.531
≥23	18	12.9	20	14.3		
Mean ± SD	21.14 ± 1.14		21.14 ± 1.21		$t = 0.051$	0.959
Academic data						
Last year grade						
Excellent	7	4.9	5	3.5		
Very good	51	24.3	44	31.4	$\chi^2 = 1.796$	$^{MC}P = 0.982$
Good	42	30.0	49	35		
Fair	40	28.5	42	30		
Previous hospital training						
Yes	64	45.7	63	45.7	$\chi^2 = 0.000$	1.000
No	76	54.3	77	54.3		

SD: standard deviation. t: Student's t test. χ^2: Chi-square test. MC: Monte Carlo. P: P value for comparing the studied groups, *statistically significant at $P \leq 0.05$.

Table 2: Comparison of nursing students' performance across different time points between the study and control groups.

Mean score of students' performance	Study group ($n = 140$) Mean ± SD	Control group ($n = 140$) Mean ± SD	U	P
In the lab (5th week)				
Total score	24.31 ± 0.81	23.07 ± 1.50	475.40	<0.001*
Percent score	97.26 ± 3.26	92.29 ± 6.01		
In the lab (6th week)				
Total score	24.09 ± 0.75	20.85 ± 1.66	386.50	<0.001*
Percent score	96.37 ± 2.99	83.40 ± 6.65		
In the hospital (10th week)				
Total score	23.93 ± 0.56	19.74 ± 2.07	121.50	<0.001*
Percent score	95.71 ± 2.23	78.97 ± 8.26		
Fr (P_0)	23.838 (<0.001*)	183.266 (<0.001*)		

SD: standard deviation. U: Mann–Whitney test. *Fr*: Friedman test. P: P value for comparing the studied groups. P_0: P value for comparing the studied periods in each other group. *statistically significant at $P \leq 0.05$.

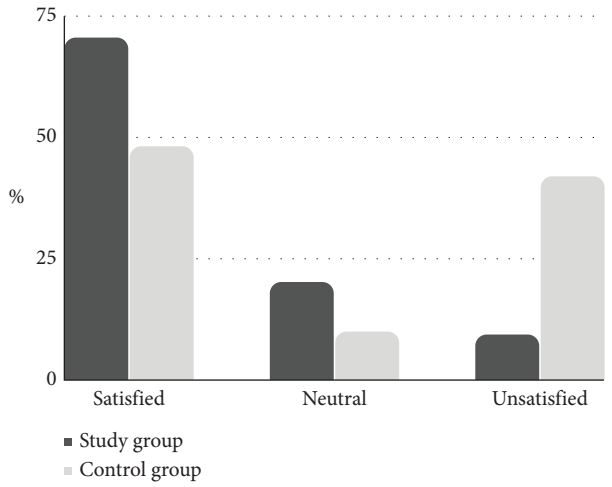

Figure 3: Comparison between study and control groups regarding their learning satisfaction.

5. Conclusion

The present study supports the use of a mnemonic learning strategy with critical care nursing students. Participants in the study group exhibited improvement in their tracheal suction procedure scores over time. In addition, the results provide critical care nursing students with an easy way to recall the steps involved in the tracheal suction process and increase students' learning satisfaction compared to the traditional method. Therefore, the mnemonic approach seems to be an effective learning strategy that can be used successfully in clinical education.

Future studies are needed to compare the effects of different mnemonic methods on the knowledge and skills of nursing students. In addition, long-term studies are needed to explore the retention of knowledge over time across different academic levels of nursing students. Moreover, other studies featuring larger groups of students are needed.

5.1. Implications for Practice. The study highlights the effectiveness of using mnemonic learning strategies in teaching tracheal suction skills to critical care nursing students. Educators and instructors can consider incorporating mnemonic techniques, such as acronyms or visualization techniques, into their teaching methods to enhance students' skill acquisition and performance.

Data Availability

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

Conflicts of Interest

The authors declare that they have no conflicts of interest that could have appeared to influence the work reported in this paper.

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