Am J Transl Res 2021;13(7):8214-8220
www.ajtr.org /ISSN:1943-8141/AJTR0131316

Original Article

The effects of Roy's adaptation model and the forgetting curve in the clinical instruction of operating room nursing interns

Weiming Qian, Lei Qian, Qin Xu, Lijun Lu

Department of Nursing, The Second Affiliated Hospital of Zhejiang University School of Medicine, Hangzhou 310009, Zhejiang, China

Received February 3, 2021; Accepted March 10, 2021; Epub July 15, 2021; Published July 30, 2021

Abstract: Objective: To investigate the effects of Roy's adaptation model combined with the forgetting curve in the clinical instruction of operating room nursing interns. Methods: 115 nursing students in our hospital were randomized and allocated into two groups: the observation group (n=60) and the control group (n=55). The control group underwent the traditional nursing instruction method, and the observation group underwent a new instruction mode guided by Roy's adaptation model combined with the forgetting curve method. The learning effects of the two groups of nursing students and their satisfaction with the nursing instruction were compared. Results: The observation group's theoretical examination score was (96.18±3.94) points, and the group's skill examination score was (83.78±5.19) points, which were higher than the corresponding scores in the control group (83.78±5.19) and (81.32±3.66), with statistical significance (all P<0.05). The operating doctors' scores on the operating room nursing students' psychological adaptability in the operating room, their proficiency in common operation cooperation, their aseptic concepts, their ability to prepare and dispose of instruments and articles, and their work and learning initiatives were significantly higher than they were in the control group, and the differences were statistically significant (P<0.05). The nursing students' professional level, interpersonal communication ability, and teaching ability scores and their total score in the observation group were significantly higher than they were in the control group (P<0.05). Conclusion: The new instruction method which combines Roy's adaptation model with the forgetting curve can not only effectively improve the nursing students' learning abilities and adaptability, but it also has an important significance in improving the relationship between doctors and nurses, the instruction relationship, and in improving the quality of the nursing instruction and the comprehensive ability of the nursing staff in the operating room.

Keywords: Roy's adaptation model, forgetting curve, clinical instruction of nursing interns, operating room

Introduction

Clinical practice is the turning point for nursing students from theory to practice. It is the key period for them to determine their life beliefs, learn clinical nursing knowledge and skills, standardize their nursing behavior, strengthen their psychological quality, and obtain all-round development [1, 2]. Moreover, their clinical practice in the operating room is their training stage. It is an important stage to cultivate the nursing students to establish good professional abilities and attitudes and to master professional skills [3]. Operating room practice is an important part of clinical instruction, because of its special environment, the high requirements of nursing technology operations, and the strong professional and other characteristics [4]. In clinical instruction, it is found that nursing students have different degrees of maladjustment reactions during clinical practice, and the adaptation status is significantly positively correlated with the practice effect. What is more, how do we achieve good instruction outcomes in the short period of clinical practice? How to cultivate high-quality nurses to adapt to the development of modern nursing is a problem that has been explored in clinical nursing instruction.

Roy's adaptation model (RAM) was put forward by American nursing expert sister Callista Roy

in 1964 [5]. Roy focuses on the adaptation level and process of human beings as an adaptation system to various stimuli in the environment. Roy believes that humans are an organic whole with physiological, psychological and social attributes, and it is also an adaptive system, which includes the individual, the family, the collective, and society [6]. It is in a state of continuous interaction with the external environment and in a continuous exchange of material and energy. The interaction between humans and the environment can not only cause internal changes, but it can also cause external changes. There are four ways to adapt to stimulation: physiological need, self-concept, role concept, and interdependence. The purpose of nursing is to promote four aspects of the adaptive response.

In this study, Roy's adaptation model combined with the forgetting curve were applied to clinical instruction management in the operating room to identify the pressure experienced by nursing students in practice and to implement an instruction intervention during their clinical nursing instruction from January 2019 to December 2019.

Data and methods

Clinical data

115 nursing students in our hospital from January 2019 to December 2019 met the inclusion and exclusion criteria and were randomized allocated into two groups: the observation group (n=60) and the control group (n=55). The researchers systematically explained the role, purpose, and process of the study to the students. The students voluntarily signed the informed consent form to participate in this study. This study was approved and recognized by the ethics committee of our hospital.

Inclusion and exclusion standards

Inclusion criteria: ① Nursing interns ≥18 years old. ② Nursing interns working in the operating room of our hospital. ③ Nursing interns who were willing to cooperate with and implement the experiment.

Exclusion criteria: Nursing students who asked to quit the study. Nursing interns who were unwilling to participate in our study.

Method

The control group: The nursing students underwent the traditional instruction method, that is, instruction before learning, speaking before practicing. According to the requirements of the instruction syllabus, the professional knowledge and practical operation of the nursing students in the operating room were taught collectively, and the teachers were assigned to follow the instruction.

The observation group: The nursing students accepted the new instruction method: 1) The teacher first provided an in-depth understanding of the characteristics of each student, had a clear instruction focus, adhered to the "student-centered" instruction concept, paid attention to the communication with the student, established a good relationship between teachers and students, and fully earned their trust. In the prime time of memory, different requirements were put forward for the different levels of nursing students in order to achieve the best effect of their own memory. The instructors encouraged and praised the progress of the nursing students in nursing learning, so as to improve their learning emotion and stimulate their learning enthusiasm. 2) In the process of instructing basic theoretical knowledge and operation skills, situational learning was arranged to ensure the students' learning effect in the two prime times of memory (early morning and before going to bed). The new instruction method based on the theory of knowledge, operating room nursing workflow, and the operating skills of classroom teaching. Before class, the relevant data of the operation were distributed, the tasks were arranged, and the nursing students were required to study before going to bed to reduce the interference of retroactive inhibition on memory. The next morning, the teacher asked questions according to the assigned tasks and the operation data, in order to reduce the interference of proactive inhibition on memory. 3) After one week of centralized instruction, the instruction mode was changed to the post instruction mode, and the "one-to-one" instruction was carried out by a guest instructor, so that the nursing students could have a comprehensive understanding of the nursing work in the operating room, and the "instruction according to person, step by step, step by step guidance and active participation" mode was adopted The principle of "and" requires the

nursing students to study actively and improve their abilities to find, analyze, and solve problems.

The two groups of nursing students were taught for one month and passed the examination 1-2 days before the end of the instruction.

Assessment of the nursing students

① *Theory examination:* The theory examination paper was in the form of a written examination. The examination questions included the operating room environment, surgical instrument disinfection, the preparation and checking of surgical instruments and articles, drug-related knowledge, basic anatomical knowledge, and cooperation methods related to neurosurgery, etc., with a total possible score of 100 points.

② *Skill examination:* The operation examination items included surgical handwashing, wearing and taking off surgical clothes, wearing sterile gloves, clamping sterile articles, the dressing preparation of surgical instruments, laying out the sterile instrument table, placing the instruments in their proper positions, the disassembly and installation method, their accuracy in transferring instruments, and setting the microscope cover, etc. according to the operation scoring standards, and the total possible score was 100 points.

Comprehensive evaluation of the nursing students by the teachers

The comprehensive nursing abilities of the nursing students was evaluated by the instructors, and included the psychological adaptability of the nursing students to the operating room, the proficiency of the nursing students in operation cooperation, the aseptic concepts of the nursing students, the preparation and disposal abilities of the nursing students' instruments and articles, and the initiative of the nursing students' work and study. Using a Likert 5-level scoring method [7], 1 indicated very poor, 2 indicated poor, 3 indicated average, 4 indicated good, and 5 indicated excellent.

Evaluation of the clinical teachers by the nursing students

An anonymous questionnaire was used to evaluate the interns' satisfaction with the clinical instruction. The Cronbach α coefficient was 0.85 and the validity coefficient was 0.7. The content of the questionnaire includes six aspects: professional level (5 items), interpersonal communication ability (5 items), behavior exemplary role (5 items), instruction ability (10 items), the scientific research level (5 items), and humanistic care (5 items), for a total of 35 questions. The Likert 4-level scoring method was used, which was divided into "never", "sometimes", "often", and "always", which were 1, 2, 3, and 4 points respectively [8]. The higher the total score, the higher the satisfaction level of the nursing students with their clinical instructors.

Statistical analysis

All the data were analyzed using SPSS 22.0. The statistical results are expressed as the mean ± standard deviation (M ± s), the data comparisons were conducted using t-tests, and the correlation analysis was conducted using the Pearson correlation coefficient, and $P<0.05$ was considered a statistically significant difference. The analyses were performed using GraphPad Prism 7 Software (GraphPad Prism, San Diego, CA).

Results

Clinical data

Table 1 shows the characteristics of the nursing students. A total of 115 nursing students were included in our study, including 60 nursing students in the observation group, with a mean age of (20.75±1.99) years, while in the control group, the students had a mean age of (21.25±1.58) years. The BMI in observation group was (19.7±1.14) kg/m^2, and in the control group it was (20.1±0.77) kg/m^2. There were no statistically significant differences between the two groups (P=0.35). In the observation group, 21.7% (13/60) had a junior high school degree, 45% (27/60) had a high school/technical secondary school degree, 21.7% (13/60) had a junior college degree, and 11.7% (7/60) had a university or higher degree. In the control group, 20% (11/55) had a junior high school degree, 34.5% (19/55) had a high school/technical secondary school degree, 38.2% (21/55) had a junior college degree, and 7.2% (4/55) had a university or higher degree. The two groups were similar in terms of their demographics and clinical characteristics, and there were no statistically sig-

Table 1. Comparison of the clinical data between the two groups

	Observation group (n=60)	Control group (n=55)	t/X^2	*P*
Age (years)	20.75±1.99	21.25±1.58	1.35	0.39
Sex			4.21	0.14
Male (n%)	23 (38.3%)	17 (30.8%)		
Female (n%)	37 (61.7%)	38 (69.2%)		
BMI	19.7±1.14	20.1±0.77	3.39	0 .35
The highest degree of nursing students			5.52	0.47
Junior high school	13 (21.7%)	11 (20%)		
High school/technical secondary school	27 (45%)	19 (34.5%)		
Junior college	13 (21.7%)	21 (38.2%)		
University and higher	7 (11.7%)	4 (7.2%)		

Note: Compared with the control group, a significant difference is P<0.05.

Table 2. Comparison of the examination results of nursing students after practice between the two groups

group	Number of cases	Theoretical examination scores	Skill examination scores
Observation group	60	96.18±3.94	91.25±3.48
Control group	55	83.78±5.19	81.32±3.66
t	-	6.243	6.395
P	-	0.000	0.000

Note: Compared with the control group, a significant difference is P<0.05.

nificant differences between the two groups (P>0.05).

Examination results of the nursing students after practice

As shown in **Table 2**, the theoretical examination score in the observation group was (96.18±3.94) points, and in control group it was (83.78±5.19) points, and there was statistically significant difference between the two groups after their instruction (P<0.05). The skill examination scores in the observation group was (83.78±5.19) points, and in the control group it was (81.32±3.66) points. The score in the observation group was higher than the score in the control group after the instruction, and there was a statistically significant difference between the two groups after the instruction (P<0.05).

Comprehensive evaluation of the nursing students by the instructors

The psychological adaptability scores in the operating room in the observation was (4.75±0.13) points, and in the control group it was (4.02±0.29) points, and there was a statistically significant difference between the two groups after the instruction (P<0.05). The proficiency in common surgical cooperation and aseptic concept scores in the observation were (4.45±0.17) and (4.72±0.15) points, respectively, and in the control group the scores were (3.33±0.21) and (3.93±0.23) points, so the score in the observation group was higher than the control group, and there was a statistically significant difference between the two group after the instruction (P<0.05). The equipment and drug preparation and disposal ability and work study initiative scores in the observation were (4.81±0.11) and (4.38±0.29) points, respectively, and in the control group the scores were (4.09±0.41) and (3.40±0.27) points, and there was a statistically significant difference between the two group after the instruction (P<0.05) (**Figure 1**).

The satisfaction of the nursing students with the clinical instructors

The satisfaction scores of the nursing students with the clinical teachers in the observation group was (96.01±2.14) points, and in the control group it was (89.67±2.79) points, and there was a statistically significant difference between the two group after the instruction (P<0.05). The professional level, interpersonal communication skills, and role model of behavior scores in the observation group were (9.51±0.49) points, (19.14±0.38) points, and (19.35±0.54) points, respectively, and the corresponding scores in the control group were (8.53±0.52) points, (17.22±0.73) points, and (18.16±0.69) points, so the scores in the observation group were higher than they were in

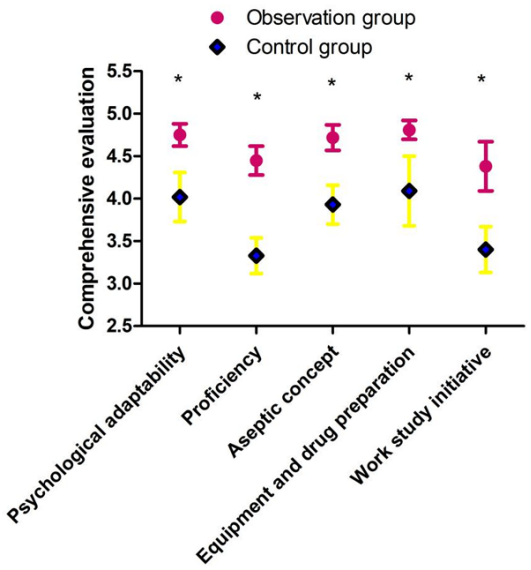

Figure 1. Comparison of the *Comprehensive evaluation of nursing students by teachers* between the two groups. Note: Compared with the control group, *$P<0.05$.

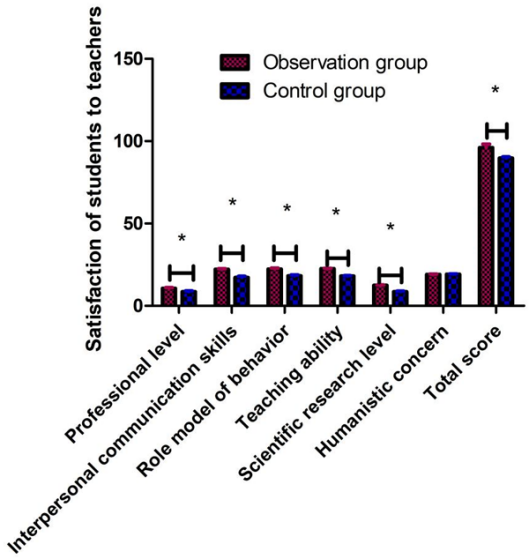

Figure 2. Comparison of *Satisfaction of nursing students to clinical teachers* between the two groups. Note: Compared with the control group, *$P<0.05$.

the control group after the instruction. The instruction ability and scientific research level scores in the observation group were (19.56±0.21) points and (9.41±0.23) points, respectively, and in the control group they were (18.06±0.23) points and (8.55±0.37) points, and there was a statistically significant difference between the two group after the instruction ($P<0.05$). The humanistic concern score in the observation group was (19.04±0.29) points, and in the control group it was (19.15±0.25) points, so there was no statistically significant difference between two group after the instruction ($P=0.084$) (**Figure 2**).

Discussion

In order to maintain his own integrity, Roy constantly adapts to the changes in the environment and exchanges information, material, and energy with the environment, so as to maintain his integrity and the stability of the internal environment [9]. After analyzing the environment changes of the nursing students in the operating room and their own or working environment stimulations, the objective stimulation factors were gradually eliminated or reduced to help the nursing students to adapt to the operating room working environment as soon as possible and the improve the quality of the instruction [10]. This study showed that the application of Roy's adaptation model combined with the forgetting curve in the clinical instruction of role adaptation of nursing interns can effectively reduce all kinds of pressure on the nursing interns, help them adapt better to the role of intern nurses, and significantly improve the quality of clinical instruction, so it is of great significance to the construction of a nursing team, the improvement of nursing quality, and the development of the discipline in the future.

The results of this study showed that the theoretical examination and operation examination scores in the observation group were higher than the corresponding scores in the control group, and the differences were statistically significant ($P<0.05$), indicating that the nursing instruction method based on the forgetting curve and memory interference theory can significantly improve the theoretical and operation levels of nursing students in the operating room.

Clinical nursing instruction is the continuation of classroom instruction and learning, and it is an important part of and a key link in training nursing professionals [11]. Operating room nursing work has the characteristics of strong professionalism, high requirements for theoretical knowledge, and the practical abilities of nursing students. In the face of heavy and

tense elective and emergency surgery, the main reaction of nursing students is "not not to understand but not to remember, not not to know but not to remember firmly", so it is easy to be absent-minded, inaccurate and not in place at work, thus slowing down the progress of surgery and delaying the surgery, directly affecting the effect of the surgery and patient safety [12]. In addition, most of the interns are only children. They lack hard work abilities, they fear getting dirty, and they fear getting tired, resulting in a series of fear, anxiety, burnout, and other negative emotions [13]. Moreover, the operating room nursing work requirements are strict, the operation cooperation is complex and diverse according to different people, and this often leads to nursing students feeling confused and unable to start, which brings great pressure on the nursing students' memories and learning, thus affecting the learning effect of the nursing students [14, 15]. Therefore, the clinical nursing instruction in operating room must be closely combined with the characteristics of the operating room environment, the nursing work, and the psychological characteristics of nursing students.

Roy's adaptation model has been widely used in various fields of the nursing industry. Applying Roy's adaptation model can help identify the problems that exist in nursing students' practice adaptation in the operating room and can provide a basis for making a comprehensive instruction strategy [16, 17]. It encourages students to actively participate in the instruction process, strengthens the information exchange and feedback between teachers and students and between students and students. Compared with the traditional instruction, the new instruction method is more conducive to enhancing the memory effect of the nursing students on theoretical knowledge and operating room procedures, and cultivates the students' independent thinking abilities, innovative spirit, and problem-solving skills [18]. The advantages of the new mode of instruction are not only reflected in the behavior of the nursing students, but also in the emotional participation of nursing students. It is not only conducive to the cultivation of an interest in learning and the stimulation of the knowledge potential of nursing students, but it is also conducive to a deeper understanding of the nursing students' occupation and the enhancement of their sense of responsibility and mission. And the new instruction method enables the teachers and nursing students to communicate, discuss, and promote each other in the whole instruction process.

In this study, the psychological adaptability, surgical cooperation proficiency, asepsis concepts, and equipment of the nursing students in the operation process were analyzed. The scores of the nursing students in the observation group were higher than the corresponding scores in the control group ($P<0.05$), which showed that the new instruction method based on the forgetting curve and memory interference theory played an important role in improving the learning and adaptive abilities of nursing students in the operating room. The new instruction method respects the law of forgetting and impresses the students deeply in their study. The operating room nursing students can master knowledge to the greatest extent. Their proficiency in operating room cooperation, aseptic concepts, and equipment preparation and disposal abilities are improved [19, 20].

In the aspect of humanistic care, there was no significant difference between the two groups ($P>0.05$), indicating that the humanistic care of the teachers did not change with the change in the instruction methods. However, in terms of the professional levels, behavior exemplary roles, interpersonal communication abilities, teaching abilities and scientific research level, the score and total score of the observation group were higher than they were in the control group, and the differences were statistically significant ($P<0.05$), which reflects the important value of the new instruction method based on the forgetting curve and on memory interference theory in improving the quality of nursing instruction and the relationship between instruction and learning in the operating room.

Applying Roy's adaptation model combined with the forgetting curve in clinical instruction in the operating room can improve the randomness of teachers' instruction and the ambiguity of the nursing students' learning purposes, promptly identify the relevant stimulation and sources of pressure of the nursing students during their internship in the operating room, and actively restructure and optimize the instruction mode, instruction content and

methods. The objective is to help nursing students adapt to the role of nursing students in the operating room, so as to improve their adaptability and instruction effects and to improve the comprehensive quality of the nursing students and to improve the quality of the instruction.

Disclosure of conflict of interest

None.

Address correspondence to: Weiming Qian, Department of Nursing, The Second Affiliated Hospital of Zhejiang University School of Medicine, 88 Jiefang Road, Hangzhou 310009, Zhejiang Province, China. Tel: +86-0571-87767237; E-mail: 2191039@zju.edu.cn

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