

**THE EFFECTIVENESS OF RAIN
CLASSROOM-BASED FLIPPED
CLASSROOM METHOD IN SURGICAL
TRAINING AMONG NURSING STUDENTS
AT THE AFFILIATED HOSPITAL OF
SOUTHWEST MEDICAL UNIVERSITY,
CHINA**

XU QIN

UNIVERSITI SAINS MALAYSIA

2024

**THE EFFECTIVENESS OF RAIN CLASSROOM-
BASED FLIPPED CLASSROOM METHOD IN
SURGICAL TRAINING AMONG NURSING
STUDENTS AT THE AFFILIATED HOSPITAL
OF SOUTHWEST MEDICAL UNIVERSITY,
CHINA**

by

XU QIN

**Thesis submitted in fulfilment of the requirements
for the degree of
Master of Science**

September 2024

ACKNOWLEDGEMENT

I would like to express my deepest gratitude to my main supervisor, Ms Hasni Binti Embong, as well as my co-supervisors, Dr Norhasmah Binti Mohd Zain and Ms Nur Adibah Binti Solihin Sulaiman. Their unwavering support and guidance not only nurtured my professional growth but also steered me in the right direction during even the most challenging moments of this journey. I am profoundly grateful to my husband, Deng Hong, whose unwavering moral support and boundless love have served as the driving force behind my progress. In addition, I would like to extend my sincere gratitude to the surgical faculty team at the Affiliated Hospital of Southwest Medical University in China for their aid. I am also extending my heartfelt appreciation to all those who directly or indirectly aided me in the completion of my thesis. Although words fail to capture the depth of my gratitude, my heart is filled with cherished memories of the affection bestowed upon me by each individual.

TABLE OF CONTENTS

ACKNOWLEDGEMENT	ii
TABLE OF CONTENTS.....	iii
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF ABBREVIATIONS	ix
LIST OF APPENDICES.....	x
ABSTRAK	xi
ABSTRACT	xiii
CHAPTER 1 INTRODUCTION	1
1.1 Background of the Study	1
1.2 Problem Statement	4
1.3 Research Question	5
1.4 Research Objectives	6
1.4.1 General Objective	6
1.4.2 Specific Objective	6
1.5 Research Hypothesis	7
1.5.1 Null Hypothesis	7
1.5.2 Alternative Hypothesis	8
1.6 Conceptual and Operational Definitions	9
1.7 Significance of the Study	11
CHAPTER 2 LITERATURE REVIEW	12
2.1 Introduction	12
2.2 Traditional Teaching Method	12
2.3 Flipped Classroom (FC)	13
2.3.1 Preparation before Class	13
2.3.2 Flipped Classroom (FC) in Clinical Nursing Teaching	14
2.4 Rain Classroom (RC) in Clinical Nursing Teaching	15
2.5 Rain Classroom-Based Flipped Classroom (RC-BFC) in Nursing Teaching ..	16

2.6	Self-directed Learning Ability between RC-BFC and Traditional Teaching Methods among Students	18
2.7	Critical Thinking Ability between RC-BFC and Traditional Teaching Methods among Students.....	19
2.8	RC-BFC Effect on Practical Exam	20
2.9	Satisfaction Level of RC - BFC Method among Students	22
2.10	Theoretical and Conceptual Framework of the Study	23
CHAPTER 3 RESEARCH METHODOLOGY		26
3.1	Introduction	26
3.2	Study Design	26
3.3	Study Setting and Population	27
3.4	Sampling Plan	29
3.4.1	Sample Criteria	29
3.4.1(a)	Inclusion Criteria.....	29
3.4.1(b)	Exclusion Criteria	30
3.4.2	Sample Size Estimation	30
3.5	Sampling Method	32
3.6	Research Instrument	33
3.6.1	Instrument	33
3.7	Practical Examination Guideline	35
3.8	Validity and Reliability	36
3.9	Variable	36
3.9.1	Variable Measurement.....	36
3.10	Data Collection Plan	37
3.10.1	Data Collection Method	37
3.10.2	Study Protocol	38
3.10.2(a)	Intervention Group.....	38
3.10.2(b)	Control Group.....	39
3.10.3	Flow Chart of Data Collection	41

3.11	Data Analysis	42
3.12	Ethical Consideration	42
CHAPTER 4	RESULTS	45
4.1	Introduction	45
4.2	Results of the Study	45
4.2.1	Social-demographic Data of the Respondents	45
4.2.2	Comparison of Self-Directed Learning Ability between RC-BFC and Traditional Method	46
4.2.3	Comparison of Critical Thinking Ability between RC-BFC and Traditional Method.....	48
4.2.4	Practical Skill Exam Results (Pre and Post) between RC-BFC and Traditional Method.....	49
4.2.5	Teaching Satisfaction Level of Students in Intervention Group	51
CHAPTER 5	DISCUSSION	54
5.1	Introduction	54
5.2	Comparison of Self-Directed Learning Ability between RC-BFC and the Traditional Method in Surgical Training among Nursing Students	54
5.3	Comparison of Critical Thinking Ability between RC-BFC and the Traditional Method in Surgical Training among Nursing Students.....	56
5.4	Comparison of Pre and Post-Practical Exam Results between RC-BFC and the Traditional Method in Surgical Training among Nursing Students.....	57
5.5	The Associations between Education Background and Practical Exam Results.....	59
5.6	The Satisfaction Level of RC-BFC in Surgical Training among Nursing Students.....	60
5.7	Strengths and Limitations of the Study	62
CHAPTER 6	CONCLUSION	64
6.1	Summary of the Study's Findings	64
6.2	Study Implication	64

6.2.1	Implication for Future Research	65
6.2.2	Implication for Nursing Educators	66
6.2.3	Implication for Nursing Practice	66
6.3	Conclusion	67
REFERENCES		69
APPENDICES		

LIST OF TABLES

	Page
Table 1.1 Definitions for the Training Terms Used in this Study.....	9
Table 3.1 Sample Size Estimation.....	31
Table 3.2 Independent and Dependent Variables.....	36
Table 3.3 Measurement of Data Analysis.....	42
Table 4.1 Social-demographic Data of Respondents (n = 286)	46
Table 4.2 Comparison of Self-Directed Learning Ability between RC-BFC and Traditional Method.....	47
Table 4.3 Comparison of Critical Thinking Ability Scale.....	49
Table 4.4 Practical Skill Exam Results.....	50
Table 4.5 The Practical Performance Results of the Two Groups of Students with Different Academic Backgrounds in the Two Skill Examinations.....	50
Table 4.6 Multiple Comparisons of Different Educational Backgrounds.....	51
Table 4.7 Teaching Satisfaction Survey (n = 143).....	52

LIST OF FIGURES

	Page
Figure 2.1 Theory of Bloom's Taxonomy from Anderson (2001).....	23
Figure 2.2 Conceptual Framework of the Study Based on Bloom's Taxonomy from Anderson (2001)	24
Figure 3.1 Flowchart of Data Collection.....	41

LIST OF ABBREVIATIONS

CPR	Cardiopulmonary Resuscitation
CG	Control Group
FC	FlippedClassroom
IG	Intervention Group
IT	Information Technology
MOOC	Massive Open Online Course
PPT	PowerPoint
RC	Rain Classroom
RC-BFC	Rain Classroom-Based Flipped Classroom

LIST OF APPENDICES

Appendix A	Social-demographic data
Appendix B	Self-directed Learning Ability Scale
Appendix C	Critical Thinking Ability Scale
Appendix D	Teaching Satisfaction Survey
Appendix E	Permission to conduct the study
Appendix F	Research Information and Consent Form
Appendix G	Gantt Chart
Appendix H	Permission to use the questionnaire and scales

**KEBERKESANAN KAEDAH RAIN CLASSROOM M-BASED FLIPPED
CLASSROOM DALAM KALANGAN PELAJAR KEJURURAWATAN
SEMASA LATIHAN PEMBEDAHAN DI HOSPITAL GABUNGAN
UNIVERSITI PERUBATAN BARAT DAYA, CHINA**

ABSTRAK

Pendidikan kejururawatan klinikal memperkasakan pelajar untuk menilai secara kritis, menyatukan dan memperkaya pengetahuan teori mereka sambil menyepadukan dengan lancar dengan aplikasi praktikal. Ia memainkan peranan penting dalam memudahkan peralihan lancar pelajar kejururawatan ke peranan klinikal masa hadapan. Rain Classroom-based Flipped Classroom (RC-BFC), yang mensinergikan teknologi termaju dan kaedah pengajaran yang inovatif, secara berkesan memenuhi keutamaan pembelajaran belia kontemporari dalam masyarakat yang dipacu maklumat. Oleh itu, ia membawa kesegaran ke dalam bidang pendidikan. Kajian ini membandingkan pembelajaran terarah sendiri dan keupayaan pemikiran kritis antara RC-BFC dan kaedah tradisional dalam kalangan pelajar kejururawatan yang menjalani latihan kejururawatan pembedahan. Kajian ini juga menentukan tahap kepuasan terhadap RC-BFC. Kajian intervensi ini telah dijalankan dalam kalangan 286 pelajar kejururawatan dari Hospital Gabungan Universiti Perubatan Barat Daya, China. Data dikumpul melalui persampelan bertujuan menggunakan soal selidik yang disempurnakan dengan mengintegrasikan skala keupayaan pembelajaran terarah

kendiri, skala pemikiran kritis, dan tinjauan kepuasan pengajaran. Pelajar dibahagikan kepada dua kumpulan: kumpulan kawalan ($n = 143$), yang mengikuti kaedah pengajaran tradisional; dan kumpulan intervensi ($n = 143$), yang menggunakan kaedah RC-BFC. Data dianalisis menggunakan perisian Statistical Package Social Sciences (SPSS) versi 26. Dapatan kajian menunjukkan bahawa markah keupayaan sendiri ($IG = 232.80 \pm 20.986$; $CG = 202.89 \pm 16.109$) dan kebolehan berfikir kritis ($IG = 266.55 \pm 8.474$; $CG = 227.72 \pm 29.030$) dalam kumpulan intervensi RC-BFC adalah lebih tinggi daripada kumpulan kawalan. Tambahan pula, markah peperiksaan amali pelajar dari latar belakang pendidikan yang berbeza dalam kumpulan RC-BFC selepas latihan adalah lebih tinggi berbanding kumpulan kawalan ($p < 0.001$). Markah kepuasan bagi kumpulan intervensi adalah seperti berikut: 2469 (82.22%) dinilai sebagai cemerlang, 530 (17.65%) sebagai berpuas hati, dan 4 (0.13%) sebagai lemah. Dapatan kajian mencadangkan bahawa integrasi RC-BFC dalam pendidikan kejururawatan membuahkan hasil yang positif. Jurang statistik yang ketara ($p < 0.001$) yang diperhatikan dalam keupayaan pembelajaran terarah sendiri, keupayaan pemikiran kritis, dan markah peperiksaan praktikal antara kedua-dua kumpulan menunjukkan bahawa pemasukan RC-BFC dalam latihan kejururawatan pembedahan berkesan memupuk pelajar berdikari dalam pembelajaran, kecekapan dalam pemikiran analitikal, dan kecekapan dalam praktikal kejururawatan.

**THE EFFECTIVENESS OF RAIN CLASSROOM-BASED FLIPPED
CLASSROOM METHOD AMONG NURSING STUDENTS IN
SURGICAL TRAINING AT THE AFFILIATED HOSPITAL OF
SOUTHWEST MEDICAL UNIVERSITY, CHINA.**

ABSTRACT

Clinical nursing education empowers students to critically evaluate, consolidate, and enrich their theoretical knowledge while seamlessly integrating it with practical application. It plays a pivotal role in facilitating the seamless transition of nursing students into future clinical roles. The Rain Classroom-based Flipped Classroom (RC-BFC), which combines advanced technology with the innovative Flipped Classroom teaching method, effectively caters to the learning preferences of contemporary youth in an information-driven society, facilitating the seamless transition of nursing students into future clinical roles. Therefore, it brings fresh vitality into the field of education. This study compares the self-directed learning and critical thinking ability between RC-BFC and the traditional method among nursing students undergoing surgical nursing training. This study also determines the satisfaction level of RC-BFC. This intervention study was undertaken among 286 nursing students from the Affiliated Hospital of Southwest Medical University, China. Data was gathered through purposive sampling using questionnaires developed by integrating the self-directed learning ability scale, critical thinking scale, and

teaching satisfaction survey. The students were divided into two groups: the control group ($n = 143$), which followed the traditional teaching method,; and the intervention group ($n = 143$), which utilized the RC-BFC method. The data was analysed using the Statistical Package Social Sciences (SPSS) software version 26. The study's findings indicate that the scores of self-directed ability ($IG = 232.80 \pm 20.986$; $CG = 202.89 \pm 16.109$) and critical thinking ability ($IG = 266.55 \pm 8.474$; $CG = 227.72 \pm 29.030$) in the RC-BFC intervention group are higher than those in the control group. Furthermore, the practical exam scores of students from different educational backgrounds in the RC-BFC group after training were higher than those of the control group ($p < 0.001$). The satisfaction scores for the intervention group were as follows: 2469 (82.22%) rated as excellent, 530 (17.65%) as satisfied, and 4 (0.13%) as poor. The research findings suggest that integrating of RC-BFC in nursing education yields positive outcomes. The statistically significant disparities ($p < 0.001$) observed in self-directed learning ability, critical thinking ability, and practical exam exams scores between the two groups indicate that the inclusion of RC-BFC in surgical nursing training effectively fosters students' independence in learning, proficiency in analytical thinking, and competence in nursing practice. In addition, the significant improvements in self-directed learning and critical thinking abilities suggest that RC-BFC could be a valuable tool in nursing education, potentially leading to more effective training programs that better prepare students for clinical roles.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Clinical nursing education allows nursing students to reinforce and extend theoretical knowledge through practical clinical experience while effectively combining it with vital clinical skills. It serves as a bridging role for nursing students to transition into future clinical positions (Jie et al., 2011). One of the major problems in clinical nursing education is the lack of coordination between theory and practice, which leads to difficulties for nursing students in implementing theoretical knowledge practically. This issue is observed on an international scale (Koukourikos et al., 2021).

Current phase of clinical nursing education in China, Huimin and Jing (2017) discovered that traditional teaching methods, such as the prevalent "one-on-one" or "observe- practice-observe" model, are dominant. In this approach, instructors initially demonstrate nursing skills and subsequently guide students to perform them after acquiring knowledge. The identification of practical skill deficiencies among students prompts additional demonstrations by instructors to ensure a comprehensive understanding of correct procedures.

However, this traditional approach lacks diversity and requires integration for improvement. As a result, it not only creates a perception of repetitive theoretical knowledge but also diminishes motivation and initiative during the learning process while reducing instructors' enthusiasm for instruction, thereby impacting educational outcomes. Therefore, updating teaching styles is crucial in order to enhance the quality of clinical nursing education.

The Rain Classroom, also known as RC, is an innovative e-learning platform that empowers educators to track students' progress in reviewing educational materials, answering questions, and managing learning time. Additionally, students

can actively respond to queries and access the 'barrage' using their mobile devices, catering effectively to individuals living in the digital era. Before classes begin, the RC platform serves as a means of distributing educational resources, creating a streamlined learning experience that enhances immediate comprehension for students and provides concise guidance for future reviews. During class sessions, interactive assessments like quizzes help gather real-time feedback from students so that teachers can understand their learning status and provide explanations accordingly. Moreover, students have the freedom to actively engage through the dynamic RC barrage feature. After classes end, timely push notifications are sent regarding unit exercises while additional learning materials based on teaching data become readily available (Panpan 2018). The range of study resources offered by RC is diverse; besides traditional PowerPoint (PPT) and Word documents, teachers can easily upload Massive Open Online Courses (MOOCs), videos, and voice courseware for improved student accessibility (Jingjing & Liwen 2016).

The Flipped Classroom (FC) teaching approach was introduced by Salman Khan, an American educator and the founder of Khan Academy, in 2011. This new teaching mode balances the learning time inside and outside the classroom (Bill, 2012; Prober & Khan, 2013). By primarily focusing on exploring teaching effects and applied research, researchers globally have attained specific findings through empirical research on FC. Some studies revealed that FC could improve students' performance, increase their motivation

and interest in learning, and enhance their higher-order thinking skills (Lopes et al., 2016; Priyaadharshini & Sundaram, 2018).

With the gradual development of FC in medical education, some researchers have introduced FC into clinical nursing teaching practice. Yilan et al. (2018) discovered that FC could improve the quality of nursing practice teaching, which is conducive to promoting comprehensive ability and teaching satisfaction among nursing students. Zhuo et al. (2018) observed that FC could improve students' learning efficiency and stimulate their interest in learning in paediatric nursing training. Ji and Li (2019) found that FC in the clinical practice of emergency nursing could improve academic performance, cultivate enthusiasm and initiative in learning, and improve comprehensive abilities concerning teamwork and emergency response.

Several authors have integrated RC and FC to develop a groundbreaking model known as the Rain Classroom-Based Flipped Classroom (RC-BFC) and successfully implemented it in nursing education. Peng et al. (2018) conducted an experiment in China with two groups of students, where the control group followed the traditional approach while the observation group utilized RC-BFC in nursing theoretical courses. The results indicated that RC-BFC significantly enhanced students' learning capabilities and training outcomes, revolutionizing nursing training through informatization, networking, and data management. Juan et al. (2018) demonstrated that RC-BFC could provide timely feedback for improved learning effects; however, there is currently a dearth of literature on its application in surgical nursing skill training. This study aims to compare the

effectiveness of the RC-BFC method with the traditional "one-on-one" or "observe-practice-observe" method in surgical skill training and offer additional options for clinical nursing teaching.

1.2 Problem Statement

Clinical nursing education plays a crucial role in enhancing students' knowledge by effectively integrating theoretical concepts with practical applications. The field of surgical nursing is characterized by its intricate nature, variability, and frequent occurrence of sudden, acute, critical, and severe situations. Consequently, surgical nurses must possess strong cognitive abilities, keen observation skills, adaptability, proficiency in practical techniques, and a profound sense of responsibility. Therefore, the surgical environment provides an ideal setting for comprehensive training (Hongjun et al., 2012). However, the traditional teacher-led teaching method solely emphasizes the explanation of professional skills and neglects fostering comprehensive qualities such as self-directed learning ability and critical thinking among nursing students.

As a result, this approach not only leads to perceiving repetitive theoretical knowledge but also reduces motivation and initiative during the learning process while diminishing instructors' enthusiasm for instruction, ultimately affecting educational outcomes. Nonetheless, fully harnessing students' learning enthusiasm continues to be challenging (Hong, 2016; Xia, 2019; Juan et al., 2018; Chunxia et al., 2018). The Rain Classroom-based Flipped Classroom (RC-BFC), which combines

state-of-the-art technology and innovative teaching methods, effectively caters to the learning preferences of today's youth in an information-driven society. As a result, it brings renewed energy into the field of education.

1.3 Research Question

The following research questions will be addressed in this study:

- i. Is there a difference in self-directed learning ability between nursing students undergoing surgical training at the Affiliated Hospital of Southwest Medical University, China, when using the RC-BFC compared to the traditional teaching method?
- ii. Is there a difference in critical thinking ability among nursing students undergoing surgical training at the Affiliated Hospital of Southwest Medical University, China, when comparing the RC-BFC method to the traditional teaching method?
- iii. Is there a difference in pre and post-practical exam results among nursing students undergoing surgical training at the Affiliated Hospital of Southwest Medical University, China, when comparing the RC-BFC method to the traditional teaching method?
- iv. Are there any associations between educational background and practical exam results among nursing students undergoing surgical training at the Affiliated Hospital of Southwest Medical University, China?

- v. What is the level of satisfaction with the RC-BFC method among nursing students undergoing surgical training at the Affiliated Hospital of Southwest Medical University, China?

1.4 Research Objectives

1.4.1 General Objective

This study aims to determine the effectiveness of RC-BFC method towards self-directed learning, critical thinking ability, and satisfaction level among nursing students undergoing surgical training at the Affiliated Hospital of Southwest Medical University, Sichuan Province, China.

1.4.2 Specific Objective

- i. To compare the self-directed learning ability of nursing students undergoing surgical training at the Affiliated Hospital of Southwest Medical University, China, when utilising the RC-BFC method and the traditional teaching method.
- ii. To compare the critical thinking ability of nursing students undergoing surgical training at the Affiliated Hospital of Southwest Medical University, China, when utilising the RC-BFC method and the traditional teaching method.

- iii. To compare the pre and post-practical exam results among nursing students undergoing surgical training at the Affiliated Hospital of Southwest Medical University, China, when utilising the RC-BFC method and the traditional teaching method.
- iv. To determine the association between education background and practical exam results among nursing students undergoing surgical training at the Affiliated Hospital of Southwest Medical University, China.
- v. To determine the satisfaction level with the RC-BFC method among nursing students undergoing surgical training at the Affiliated Hospital of Southwest Medical University, China.

1.5 Research Hypothesis

1.5.1 Null Hypothesis

- i. There is no statistically significant difference in self-directed learning ability between the RC-BFC method and the traditional method in surgical training among nursing students at the Affiliated Hospital of Southwest Medical University, China.
- ii. There is no statistically significant difference in critical thinking ability between the RC-BFC method and the traditional method in surgical training among nursing students at the Affiliated Hospital of Southwest Medical University, China.

- iii. There is no statistically significant difference in pre and post-practical exam results between the RC-BFC method and the traditional method in surgical training among nursing students at the Affiliated Hospital of Southwest Medical University, China.
- iv. There is no statistically significant difference in pre and post-practical exam results between the RC-BFC method and the traditional method in surgical training among nursing students from different educational backgrounds at the Affiliated Hospital of Southwest Medical University, China.

1.5.2 Alternative Hypothesis

- i. There is a statistically significant difference in self-directed learning ability between the RC-BFC method and the traditional method among nursing students in surgical training at the Affiliated Hospital of Southwest Medical University, China.
- ii. There is a statistically significant difference in critical thinking ability between the RC-BFC method and the traditional method among nursing students in surgical training at the Affiliated Hospital of Southwest Medical University, China.
- iii. There is a statistically significant difference in pre and post-practical exams between the RC-BFC method and the traditional method in surgical training among nursing students at the Affiliated Hospital of Southwest Medical University, China.

iv. There is a statistically significant difference in pre and post-practical exam results between the RC-BFC method and the traditional method in surgical training among nursing students from different educational backgrounds at the Affiliated Hospital of Southwest Medical University, China.

1.6 Conceptual and Operational Definitions

Table 1.1 Definitions for the Training Terms Used in This Study

Terms	Definition
Traditional teaching method	Currently, the majority of clinical nursing education adopts traditional "one-on-one" and "observe- practice-observe" approaches, wherein a clinical instructor provides guidance to students during follow-up teaching sessions (Qin, 2018). In this study, students acquired knowledge through observing the instructor's demonstrations. After obtaining patient consent, students performed nursing skills while being examined and monitored by the instructor. Subsequently, the instructor would emphasize any weaknesses observed in the student's performance and provide correct demonstrations.
Rain Classroom (RC)	According to Shuaiguo (2017), RC is an intelligent educational tool developed by Tsinghua University, China, in response to the rapid advancement of information technology. In this study, RC serves as an online teaching platform that allows teachers to monitor students' progress in previewing materials, their answers, and learning time at any given moment through the RC platform. Additionally, teachers can promptly receive feedback from students. Moreover, students can utilize their mobile devices to answer questions and engage in interactions and activities such as demonstrations via the RC barrage feature, random roll call, and red envelop, which is particularly suitable for individuals living in the digital era. The range of study resources that can be uploaded onto RC is diverse and dynamic. Apart from traditional PowerPoint (PPT) and Word documents, teachers have the option to incorporate Massive Open Online Course (MOOC) videos and voice courseware into their teaching repertoire so as to provide comprehensive educational resources for students.

Table 1.1 Continued

Terms	Definition
Flipped Classroom (FC)	The FC model represents an innovative pedagogical approach that challenges traditional classroom and post-class teaching methods while also fostering personalized learning among students (Bill, 2012; Prober & Khan, 2013). This study utilizes video uploads for knowledge acquisition and information assimilation outside of class hours as part of a fragmented educational strategy to facilitate independent student learning. Valuable in-class time is dedicated to teacher-student communication and inquiry-based learning.
Rain Classroom- Based Flipped Classroom (RC- BFC)	The online teaching platform Rain Classroom (RC) was implemented in the Flipped Classroom (FC) model known as RC - BFC, according to Juan et al. (2018). This study integrated the advantages of RC and FC based on a three-shift clinical working mode that enables students to flexibly schedule their learning time and take control of their learning initiative. Teachers assume the role of guiding.
Surgical nursing training	Clinical nursing training is essential for nursing students during their internship as it plays a crucial role in reflecting the quality of nursing education. Standardization and precision in practice are vital factors that contribute to this reflection. The field of surgical nursing is characterized by its intricate nature, variability, and frequent occurrence of sudden, acute, critical, and severe situations. Consequently, surgical nurses must possess strong cognitive abilities, keen observation skills, adaptability, proficiency in practical techniques, and a profound sense of responsibility. Therefore, the surgical environment provides an ideal setting for comprehensive training (Hongjun et al., 2012). This study encompasses five specialized departments: Orthopaedics, gastrointestinal surgery, spine surgery, vascular surgery, and thoracic surgery. Furthermore, it covers all levels of nursing interns' education.

1.7 Significance of the Study

By implementing an innovative approach, FC has successfully revolutionized various fields of medicine, embracing student-centered learning and collaborative learning communities (Yu et al., 2021). However, there is a lack of relevant literature exploring the application of RC-BFC in surgical nursing skill training. Therefore, this study aims to investigate different developmental strategies for clinical nursing education in surgical training with the objective of enhancing the comprehensive skills of nursing students. The widespread adoption of RC-BFC presents challenges due to disparities in educational informatization across regions (Rui et al., 2021). This research was conducted at a teaching hospital situated in a non-first-tier city in China where accelerated informatization and networking development are anticipated. Hence, it is crucial to adapt the RC-BFC model according to local conditions to enhance its universality and serve as a fundamental basis for promoting future educational informatization.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This literature review summarises and analyses research progress related to FC in nursing education. The chapter aims to provide a reference for RC-BFC practice in surgical nursing education. This literature review covers the pre-class preparation, teaching process, evaluation indicators, and conceptual framework.

2.2 Traditional Teaching Method

In China, most clinical teaching applies traditional "one-to-one" and "see-do - see" modes. Qin (2018) compared conventional and other teaching methods and found that traditional teaching allowed clinical teachers to lead students in follow-up teaching. After obtaining the patient's consent, the teacher would ask the students to demonstrate some nursing skills while the teacher monitored and examined them. After the student completes the procedure, the teacher highlights the student's weaknesses and demonstrates the correct procedure. Chunxia et al. (2018) asserted that traditional clinical teaching is a teacher-led method that focuses on explaining professional skills. The authors highlighted the need to pay more attention to cultivating the comprehensive quality of nursing students. Nevertheless, it is challenging to mobilise students' learning enthusiasm fully.

2.3 Flipped Classroom (FC)

Originating from the United States, FC utilises information technology (IT) as the flipping medium, where micro-lectures (videos) are used as a carrier for students to self-study. In-classroom teaching serves for teacher-student communication, cooperation, and knowledge internalisation. Although different researchers offer multiple views on the understanding of FCs, certain commonalities exist in their definitions. This commonality is primarily reflected in the following three aspects:

- i. The FC is an innovative teaching method. One of its significant features is integrating the development and utilisation of modern IT (micro-courses, internet, and others) and the practice of classroom reformation.
- ii. The learning sequence of "knowledge transfer" and "knowledge internalisation" is reversed.
- iii. In the FC model, the traditional subject relationship is reversed, with students taking on the role of active learners in flipped learning while the teacher serves as a facilitator and guide.

2.3.1 Preparation Before Class

Fei et al. (2018) wrote several teaching cases for FC in which a double-qualified teaching team composed of full-time teachers and specialist nurses prepared lessons collectively. This study designed teaching objectives, collected clinical cases with typical characteristics, and integrated them into standardised

cases. By gathering materials, Qiao et al. (2020) recorded 39 micro-courseware designed with pictures, animations, and clinical cases. They developed a study guideline including study topics, objectives, study method suggestions, and links to teaching resources. They also integrated the key and difficult points into learning tasks. To sum up, pre-class preparation plays a pivotal role in fostering students' interest. Hence, when designing materials and activities for pre-class teaching, it is essential to consider diversity and incorporate elements of enjoyment.

2.3.2 Flipped Classroom (FC) in Clinical Nursing Teaching

The field of nursing has seen consistent positive teaching outcomes in several FC studies, which offer valuable references for this study. Min et al. (2019) conducted a study to carry out cardiopulmonary resuscitation (CPR) training using FC among new nurses through the online platform WeChat. This study discovered that FC could improve the theoretical, practice performance and student satisfaction related to CPR. Panpan et al. (2019) explored the effectiveness of FC based on the e-teaching platform in the introductory nursing practice course. In this study, the researcher randomly divided the students into intervention and control groups according to the class. The control group employed the traditional method, while the intervention group adopted FC. The teacher uploaded all the skill items to the e-teaching platform before class and extracted and analysed the frequent issues that students faced after self-learning. Subsequently, they explained these problems as the central points of in-class teaching. Students would be randomly selected to demonstrate each skill project during the in-class teaching. After the performance, they would self-evaluate before other students raise

questions and discuss the project. Subsequently, the teacher would summarise and submit the summary to the e-teaching platform for students' review after class.

Jing et al. (2023) conducted a study by assessing 44 undergraduate nursing students in the gynaecology department using FC. They divided the students into experimental and control groups, with 22 students assigned to each group. The results revealed that the experimental group's practical exam scores and satisfaction scores were higher than those in the control group, indicating that FC had a positive effect on the teaching effect of clinical nursing.

2.4 Rain Classroom (RC) in Clinical Nursing Teaching

Jointly developed by Tsinghua University and Xuetang Online, RC is a new type of intelligent toolbox for teaching. It has been specially designed to be utilised in a blended learning model. It provides real-time and personalised analysis of students' learning performance. Compared to other learning platforms, RC achieves the "learning anytime, anywhere" objective and realises the new concept of data-driven teaching. Teachers can make teaching adjustments based on the statistical analysis of students' study completion and their performance in class from RC and include these data in student evaluations. Under this teaching mode, a 'one test determines the students' high or low performance' approach no longer exists. The specific performance in the learning process can comprehensively reflect their learning situation.

Xiaorong (2020) conducted a study in which three prepared cases were sent to RC during the first, second, and third weeks after students entered the

department. The students were then instructed to engage in case analysis, review data, and engage in problem-solving to submit answers to case questions on time. At the same time, the students could discuss in RC. The teacher collected the answers, summarised the common problems, and adjusted the lecture content in time. In the fourth week, the teacher organised a question-and-answer session and conducted classroom quizzes in RC. Ang (2021) applied RC to nursing clinical training by undertaking several steps. First, the students used RC to submit questions after self-learning before class, and the teacher explained the answers to the questions posed. Secondly, a student is chosen to perform the skill while other students evaluated and discussed during in-class teaching. The teacher would demonstrate and define the critical steps in detail. Subsequently, the students joined group practice and made real-time corrections according to their situations. Finally, after the training, the teacher would receive the lecture summary uploaded through RC, including the class attendance rate, the preview of the students for this course, messages, discussion on a certain knowledge point, and other information. Resultantly, the teacher is aware of students' learning situations and provides targeted instructions. Multiple studies suggest that RC is an intelligent online platform that supports various teaching activities and is compatible with nursing education, providing valuable references for this study.

2.5 Rain Classroom-Based Flipped Classroom (RC-BFC) in Nursing Teaching

Peng et al. (2018) used RC to carry out FC in nursing training courses in China. In this study, the intervention group adopted RC-BFC, and the research process was as follows: First, the teacher sent some learning videos to RC and told students to

preview them by themselves. Secondly, the teacher organised a question-and-answer session during classroom teaching and chose one student to perform. The teacher provides explanations, directions, and demonstrations when necessary. After the training, students undergo a practice test and fill in a self-administered satisfaction questionnaire and a student learning ability questionnaire to test their learning mastery.

Fei et al. (2018) adopted RC-BFC in the course of nursing introduction in China. A total of 106 nursing students were assigned into a control group comprising 52 students and an intervention group encompassing 54 students according to their classes, receiving either conventional teaching or RC-BFC. After the training, all students sit for an exam and complete a self-administered satisfaction questionnaire. The results showed that RC-BFC could effectively improve teaching quality. Dingrong (2021) conducted an RC-BFC study in psychiatric nursing. The researcher applied Ocam software to record psychiatric nursing teaching courseware. The course was uploaded and made accessible to 39 students before the class, and the students were invited to preview it. The teacher conducts online teaching through RC to explain the course's vital and complex points and interact with the students. They also pose questions and provide answers after class to deepen knowledge mastery through WeChat. The results showed that RC-BFC improved the effectiveness of psychiatric nursing teaching and increased students' participation and satisfaction. Despite the application of RC-BFC in various educational settings, there is a dearth of research on its effectiveness in surgical nursing training, especially within non-Western contexts. This study aims to fill this

gap by investigating the influence of RC-BFC on self-directed learning and critical thinking among nursing students in China.

2.6 Self-directed Learning Ability between RC-BFC and Traditional Teaching Methods among Students

In a study conducted by Yanhua et al. (2019), 64 new nurses who joined in 2017 were assigned to the control group, where traditional methods were used for skill training. Additionally, 67 new nurses who entered the job in 2018 were assigned to the intervention group, where RC-BFC was utilised for skill training. The results showed that the self-directed learning ability score of the intervention group was significantly higher than that of the control group ($p < 0.01$). A total of 91.04% of the new nurses in the intervention group stated that pre-job skills training of RC-BFC can improve learning interest. It also showed that the application of RC-BFC in the pre-job skill training among new nurses could cultivate their independent learning ability. Rui et al. (2021) used the Self-directed Learning Ability Evaluation Scale to evaluate nursing students' academic progress in psychiatric nursing courses that adopt RC- BFC in a university. The results showed that RC-BFC can improve students' self- learning ability and strengthen knowledge learning and thinking expansion.

Na (2020) explored the teaching of surgical nursing by selecting 132 students from four classes as the RC-BFC group. The RC-BFC method was applied in the theoretical course of surgical nursing. In addition, 130 students from four classes were selected as the control group, where the traditional teaching method based on

teacher-led lectures was implemented. The results revealed that students' scores in the RC-BFC group's self-management, information, learning, and cooperation abilities were significantly better than those of the control group. The difference was statistically significant, indicating that the RC-BFC teaching mode was conducive to improving students' self-directed learning ability and implementing an efficient information-based teaching method. The use of RC-BFC has been demonstrated to enhance students' ability for self-directed learning in various nursing fields, providing valuable insights for this study when compared to traditional teaching methods.

2.7 Critical Thinking Ability between RC-BFC and Traditional Teaching Methods among Students

Yan et al. (2019) discovered that the critical thinking scores of nursing students in both groups were lower than 280 points, implying that the tendency towards a critical thinking attitude was unknown. Nevertheless, scores for aspects of looking for the truth, opening mind, analytical ability, curiosity, and critical thinking skills in the RC-BFC group were significantly higher than in the control group.

Panpan et al. (2019) adopted the Critical Thinking Ability Scale, which was translated and revised by Meici et al. (2004) of Hong Kong Polytechnic University. This study's results revealed that the scores of all dimensions of critical thinking ability of the RC-BFC group were higher than those in the control group. The result could be attributed to the fact that students in the RC-BFC

group had adequate discussions to obtain knowledge affirmation and correct deviations to promote self-confidence and cognitive maturity in critical thinking.

Huiwen (2023) undertook a study by selecting 24 undergraduate students as the control group and 26 students as part of the RC-BFC group. The control group used the traditional teaching method, while the RC-BFC group adopted the RC-BFC teaching method. In the RC-BFC group, the teacher uploads the learning materials related to each case to the RC before class. During the class, the "barrage" and other functions of the RC encouraged students to think positively and speak freely. After class, students are guided to conduct intensive training, learning and exploring knowledge, and finally, complete the internalisation and application of knowledge. The results showed that students' critical thinking scores in the RC-BFC group were higher than those in the control group, and the difference was statistically significant. The research findings from multiple studies demonstrate the remarkable efficacy of RC-BFC in enhancing students' critical thinking abilities, thereby establishing it as a valuable point of reference for this study.

2.8 RC-BFC Effect on Practical Exam

Yanyan (2023) examined RC-BFC by selecting 60 nursing interns in the Department of Neurology from January 2021 to January 2022. The students were divided into control and intervention groups using a random number table. The control group, which comprises 18 college students and 12 undergraduates, applied the traditional teaching method. On the other hand, the RC-BFC method was

applied in the intervention group, comprising 19 junior college students and 11 undergraduate students. The results showed that there was no significant difference in the pre-training practice exam scores between the two groups, regardless of whether they were undergraduates or college students ($p > 0.05$). The RC-BFC group had higher post-training practice exam scores than the control group ($p > 0.05$). The reason may be that trainee nurses passively accept relevant knowledge under traditional teaching, which affects the overall teaching effect due to individual differences in comprehension ability. Concurrently, RC-BFC pays attention to the interaction between teachers and students, allowing them to start learning relevant knowledge independently before and during class, check and fill in gaps, and expand understanding after class to ensure knowledge mastery. It helps students develop their self-directed learning ability while improving the teaching effect.

Lei Y. (2019) studied the application of RC-BFC among secondary school nursing students in Obstetrics and Gynaecology teaching. The researcher divided the students by placing 36 students in the RC-BFC group and another 32 students in the control group. Students must complete self-study tasks conscientiously within the specified time, and teachers are not required to utilise class time to comprehensively explain tasks students must complete in small groups before class. After students undergo an in-depth preview before class, the teacher can help students understand difficult points in a targeted manner during classroom teaching and evaluate the learning effect through case discussions. After class, the teacher analyses the results of the cases and discusses and shares

them with the students through the RC. The students can consult them at any time. The results revealed that the students in the RC-BFC group students fully exercised their subjective initiative throughout the learning process and paid attention to understanding and applying knowledge. The obstetrics and gynaecology exam results of students in the intervention group also improved significantly compared with those of students in the control group. Multiple research findings have demonstrated that the use of RC-BFC significantly enhances students' performance in skill exams, providing valuable insights for this study.

2.9 Satisfaction Level of RC - BFC Method among Students

Juan et al. (2018) discovered that nursing students were more willing to study for a master's degree than those in the control group through an RC-BFC study. Another study conducted in China by Peng et al. (2018) discovered that students' satisfaction significantly increased with RC-BFC. This teaching method, which integrates IT, may represent a contemporary approach to education. Ning et al. (2021) demonstrated that RC-BFC improved nursing students' learning initiative and participation. Students are more willing to accept this interactive teaching method than traditional methods and have higher satisfaction.

Hongmei (2021) explored RC-BFC in the Department of Respiratory and Critical Care Medicine, with 62 nursing students in the control and RC-BFC groups, respectively. The control group adopted the traditional teaching method, and the RC- BFC group implemented the RC-BFC teaching mode. The results revealed

that the students in the RC-BFC group had higher satisfaction scores than those in the control group. This finding indicates that the RC-BFC teaching method in the Department of Respiratory and Critical Care Medicine could effectively improve teaching satisfaction. The RC-BFC teaching mode extends the online communication time between teachers and students, enabling students to consult teachers actively and in a timely manner. The research findings from multiple studies on RC-BFC suggest that the implementation of RC-BFC can significantly enhance students' satisfaction, thereby offering valuable insights for this study.

2.10 Theoretical and Conceptual Framework of the Study

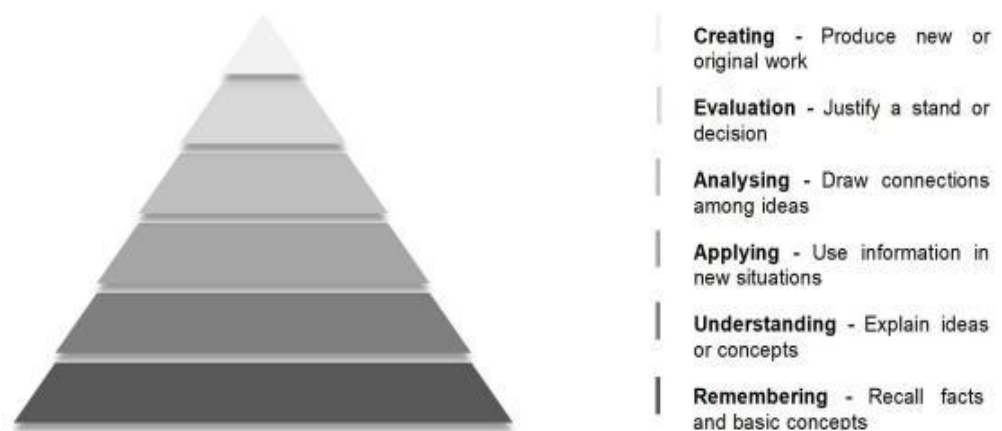


Figure 2.1: Theory of Bloom's taxonomy from Anderson (2001)

The formation and development of FC draw on insights from various educational theories to enhance its scientific foundation. Bloom's taxonomy (revised) from Anderson (2001) has been well interpreted and implemented in

FC. Students independently accomplish more than low-level cognitive work, such as memorising and acquiring knowledge. Additionally, they engage in high-order mental work, such as knowledge application, analysis, and synthesis, during class time with the support of peers and instructors, thus achieving multi-level cultivation and improvement in the cognitive field (Galway et al., 2014; Gilboy et al., 2015).

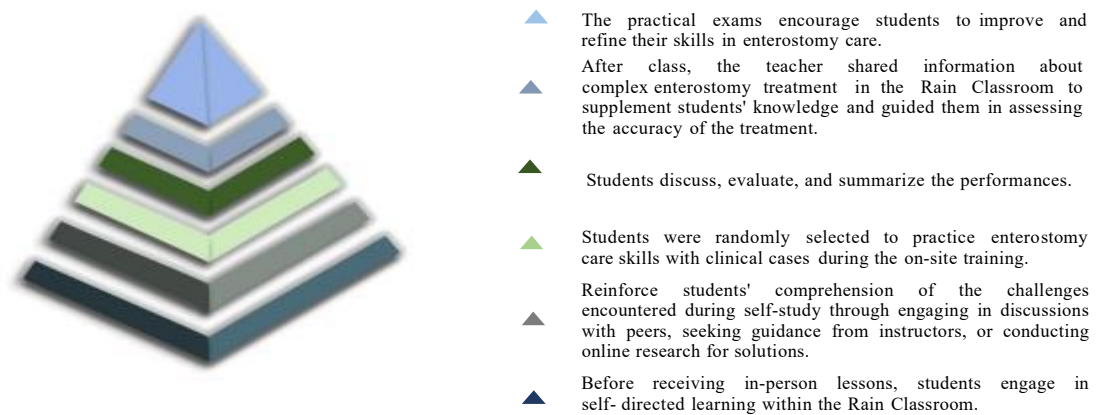


Figure 2.2: Conceptual framework of the study based on Bloom's taxonomy from Anderson (2001)

The purpose of this study is to make use of the revised Bloom's taxonomy model proposed by Anderson (2001) as a reference and divide the teaching process into two distinct parts: extracurricular activities and in-class activities. To accommodate for the different shifts during the internship, students were instructed to engage in pre-class studying based on their available time. They were provided with various learning materials such as PPT slides, instructional videos, bibliographies, and other resources within the resource