BRITISH JOURNAL OF HOSPITAL MEDICINE

ARTICLE

Effects of the Information Motivation Behavior Combined With Flipped Classroom Teaching Model on the Professional Competence and Creative Thinking of Urological Nursing Interns

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Abstract

Aims/Background Lack of motivation and poor learning habits lead to ineffective teaching in flipped classrooms. Information Motivation Behavior (IMB) theory facilitates the adaptation and modification of individual behavior through information, motivation, and behavioral intervention. This study aims to explore the effects of a combined IMB and flipped classroom teaching model on the professional competence and creative thinking of urological nursing interns.

Methods A total of 85 undergraduate nursing interns who practiced in the Department of Urology from July 2023 to March 2024 were selected for retrospective analysis. The interns were divided into two groups based on the teaching model: the control group (n = 45, flipped classroom) and the study group (n = 40, IMB combined with the flipped classroom). The theoretical and practical scores were detected to assess the professional competence of students. Marmara Creative Thinking Dispositions Scale (MCTDS) scores, and California Critical Thinking Skills Scale-Chinese Version (CTDI-CV) scores were measured before and after training. Students' satisfaction with the teaching format and its effectiveness was compared between the two groups.

Results The theoretical and practical scores, as well as the MCTDS and CTDI-CV scores, were significantly increased in both groups after training compared to before training ($p < 0.05$), with the degree of improvement being higher in the study group than in the control group. After training, the theoretical and practical scores were higher in the study group than in the control group ($p < 0.001$). The self-discipline, innovation search, courage, inquisitiveness, doubt, flexibility, and total MCTDS scores were also higher in the study group compared to the control group ($p < 0.001$). Similarly, the truth-seeking, analyticity, open-mindedness, inquisitiveness, maturity in judgment, and total CTDI-CV scores were markedly higher in the study group than in the control group ($p < 0.001$). Additionally, students' satisfaction with the teaching format and effectiveness was significantly greater in the study group than in the control group ($p < 0.001$).

Conclusion The combination of IMB and the flipped classroom in urological nursing education demonstrated effective teaching outcomes and high satisfaction levels. It enhanced students' professional competence, critical thinking, and creative thinking. However, as this study focused exclusively on urological nursing interns, the results may not be generalizable to the education of other types of nurses.

Key words: information motivation behavior; flipped classroom; creative thinking; urological nursing education; professional competence

Submitted: 10 October 2024 Revised: 7 February 2025 Accepted: 10 February 2025

How to cite this article:
Zheng S, Wang H, Chen C. Effects of the Information Motivation Behavior Combined With Flipped Classroom Teaching Model on the Professional Competence and Creative Thinking of Urological Nursing Interns. Br J Hosp Med. 2025. https://doi.org/10.12968/hmed.2024.0739

Introduction

Urology is a significant surgical specialty, with urological disorders accounting for 10–15% of general practitioners' appointments and 21.9% of acute surgical referrals (Ng et al, 2022). Urological nursing is characterized by its complexity and multitasking nature, placing high demands on the professional competence, knowledge, and professionalism of nursing staff (Jarosz and Młynarska, 2023). Therefore, training urological nurses with specialized skills and professionalism is a critical focus. Nurses frequently encounter emergencies and unexpected situations, requiring them to possess not only specialized skills but also the creativity and critical thinking necessary to analyze and resolve problems quickly and accurately (Taşdelen Baş et al, 2022). Moreover, innovation plays a crucial role in improving the quality of medical services and reducing care costs (Liu et al, 2020). The importance of fostering creative thinking is increasingly being recognized in nursing education worldwide (Liu et al, 2020).

In recent years, exploration and innovation in nursing education models have become a key focus in higher education. For nursing interns who have not yet undergone professional training, teaching models significantly influence teaching effectiveness (Gcawu and van Rooyen, 2022; Rosli et al, 2022). The traditional teacher-centered teaching model may be considered by students to be monotonous and as a consequence they lack motivation for learning (Du et al, 2022; Sezer and Esenay, 2022).

The flipped classroom is a newer teaching model characterized by students' active participation in the learning process. It changes the order of the educational process. In this model, students independently complete learning activities outside of class time by watching teaching videos, reading related materials, and searching data from websites before attending the classroom. In the classroom, teachers spend time on interacting with students, including practical activities and guidance, discussion and problem solving (Özbay and Çınar, 2021; Sullivan, 2022). Research indicates that the flipped classroom increases student motivation and engagement while supporting the integration of classroom knowledge into nursing practice (Sullivan, 2022). However, this model primarily emphasizes the internalization and absorption of knowledge by students during the teaching process, rather than demand details about the learning (Jovanović et al, 2017; Tomas et al, 2019). Additionally, the motivation and abilities of students can impact the effectiveness of the flipped classroom (Lai et al, 2021).

A lack of inclination for active learning, insufficient self-motivation, poor organizational skills, and ineffective learning habits and methods are key factors contributing to the suboptimal outcomes of the flipped classroom (Sosa Díaz et al, 2021). Therefore, supplementary measures are needed to mitigate these factors and enhance the teaching effectiveness of the flipped classroom model.

Several behavioral intervention models have been developed to increase motivation and engagement in making a change in behavior. These models include the transtheoretical model, the theory of reasoned action, the theory of planned behavior, and the Information Motivation Behavior (IMB) model. IMB is a theoretical

model of behavior change that has been used to design appropriate strategies for altering personal behaviors (Kim et al, 2023). Compared to other behavioral intervention frameworks, the IMB model integrates multiple theories, providing a structured and systematic research process. Additionally, it is highly operational and applicable (Liu et al, 2014; Tsamlag et al, 2020). The IMB model can provide both an understanding of an individual's behavior and inform approaches to changing behavior. There are three core components: information, motivation, and behavior. Based on IMB model, "Information" includes the necessary information required for a specific behavior; "Motivation" consists of personal and social motives for the behavior; and "Behavior" represent the skills necessary for the behavior (Tsamlag et al, 2020; Udomkhwamsuk et al, 2024). The IMB model has been widely applied in the self-management of chronic diseases such as diabetes, hypertension, and hyperlipidemia, as well as in health education (Ferrari et al, 2021; Udomkhwamsuk et al, 2024). A study conducted in Iran applied the IMB model to improve teachers' professional competence in sexuality education and achieved significant results (Maasoumi et al, 2024). It has also demonstrated positive effects on health-promoting lifestyles among students (Molaifard et al, 2018). However, the effects of IMB in nursing education, particularly within the urology department, have not yet been reported.

Previous studies have explored the effectiveness of teaching models that combine the flipped classroom with other methods, such as problem-based learning (Chang et al, 2022) and virtual simulation platforms (Sun et al, 2023). However, these models still lack interventions targeting student behavior and motivation. Adequate motivation and effective study habits yield significant benefits for students, improving not only academic performance and skills but also their thinking patterns (Vu et al, 2022). Given the demonstrated effects of the IMB model on individual behavior and motivation, we speculate that IMB could effectively address potential shortcomings of the flipped classroom and enhance teaching effectiveness.

In the IMB model for teaching, information serves as the foundation for shaping behavior. It involves providing students with accurate and relevant content about the teaching materials, thereby enhancing their comprehension. This enables students to make informed decisions and take appropriate actions to actively engage in the learning process. Motivation, a critical driver of behavioral change, is fostered through sustained, step-by-step communication between teachers and students. This approach seeks to understand and stimulate students' learning motivation, establish trust, and encourage a willingness to embrace behavioral changes. Learning motivation can be further enhanced by setting achievable goals and emphasizing the benefits of these changes. Behavior focuses on the practical learning processes of students, including providing teaching-related materials, techniques, and consulting opportunities. This component includes multiple activities such as goal setting and problem-solving to facilitate active learning.

Building on this framework, the present study aimed to explore the effects of a combined IMB and flipped classroom teaching model on the professional competence and creative thinking of urological nursing interns. By innovatively integrating IMB into the flipped classroom, this study addresses a gap in the existing

literature on clinical teaching. Furthermore, it offers a potential new solution for enhancing the quality of nursing education.

Methods

General Information

This is a retrospective survey. The participants were nursing students who interned in the Department of Urology, Wenzhou People's Hospital from July 2023 to March 2024. This study was approved by the ethics committee of Wenzhou People's Hospital (Approval Number: KY-202406-002) and complied with the Declaration of Helsinki. All participants were informed and agreed to participate in the study. A total of 85 students participated in the research and were divided into two groups based on differences in the teaching model: (1) Control group (n = 45): flipped classroom teaching model; (2) Study group (n = 40): IMB combined with the flipped classroom teaching model. Inclusion criteria: (1) College nursing students in their third year; (2) Students who have achieved standard grades in nursing courses and have no adverse records; (3) Students who volunteered to participate in this study. Exclusion criteria: (1) Students who have previously undertaken nursing internships in other departments or urology departments; (2) Students unwilling or uncooperative with the teaching.

Teaching Methods

Teachers were professional nurses with at least 3 years of experience in urology and at least one year of teaching experience. All students participated in a 4-week internship training. The students in the control group adopted a flipped classroom teaching model. Specifically, teachers organized relevant teaching materials, such as documents, videos, or pictures, based on the plans and objectives of nursing education in urology. These materials covered topics including workflow, rules and regulations, instructions for medical instruments and drugs, clinical practice, nursing care for various diseases, complications, first aid measures, and precautions. These materials were distributed to students one week before the training. Students were expected to study the relevant content independently, and the teacher would explain and demonstrate difficult or unclear knowledge and skills. The main goal was to ensure that students had a certain amount of nursing knowledge in urology before the training.

At the beginning of the training, the teacher would guide the students in quickly familiarizing themselves with the department environment. Afterward, the role of the teacher shifted to the students. Students participated in nursing care based on the prior materials and learning, educating the teachers on relevant operations and specialized knowledge, such as conducting case analyses, developing nursing care plans, inspecting wards, presenting work-related problems, critiquing the teachers' nursing skills, and teaching professional knowledge and skills to the teachers. Students could discuss and analyze any issues they encountered, while the teacher listened to and supplemented the students' comments. Teachers managed the overall

progression of the instruction based on the learning situation, but the students were the main participants.

The study group adopted an IMB-guided flipped classroom teaching model. Students used the same teaching materials and flipped classroom teaching mode as the control group. In addition, the IMB model was incorporated to guide students in actively participating in the teaching. The specific components included Information Intervention, Motivation Intervention, and Behavioral Intervention.

Information Intervention: A survey form was developed to assess teaching requirements, including students' understanding of the content of the urological nursing internship, topics of interest, areas of confusion, and difficulties. The survey was completed by the students, and teachers used the responses to assess the general learning situation. Teachers then provided uniform answers to commonly raised issues, while specific concerns were addressed individually with the students. The primary means of communication were phone and internet.

Motivation Intervention: This section was divided into several stages to gradually cultivate and improve students' study habits and attitudes. (1) First, teachers actively communicated with students to understand their psychology and needs, establishing good teacher-student relationships. This required communication with students before the internship. It is important to note that communication occurred throughout the internship, and smooth communication was a crucial prerequisite for the program. (2) Second, teachers reinforced students' desire to gain knowledge and skills while correcting poor study habits and attitudes. This also needs to be addressed before the internship. Special attention was given to interns who lacked motivation or self-learning habits, with timely corrections made when necessary. (3) Third, teachers helped students set both long- and short-term learning goals and developed individualized learning plans to ensure reasonable and scientific study. This program continued throughout the internship. Special attention was given to interns who were slow to adapt to nursing work in urology, with appropriate goals and psychological counseling provided. (4) Fourth, before implementing the flipped classroom teaching model, students were asked about their readiness for the course, and the study program was adjusted accordingly. During the teaching period, teachers kept track of students' learning progress and attitudes, guiding them to maintain a positive study attitude. Additionally, the teaching arrangement was adjusted based on learning progress to ensure the scientific feasibility of the teaching and to stimulate enthusiasm for learning.

Behavioral Intervention: A systematic approach was adopted to intervene in student learning behavior. Question Raising: Based on the teaching program and the actual environment, teachers proposed problems that needed to be addressed, such as handling emergency situations, performing difficult clinical operations, and doctor-patient communication. Problem Solving: Students actively sought answers and provided comprehensive responses to problems during the training process. Discussion and Summary: Weekly discussion and summary sessions were conducted. Students summarized their learning progress and organized their study plans. The teacher also analyzed the difficulties and issues encountered during the study process and assisted the students in finding solutions.

Assessment of Professional Competence

The professional competence were assessed through a theoretical test and a practical test before and after the training. For the theoretical test, students completed questions randomly selected from the question bank. The total score was 100 points, with higher scores indicating better mastery of theoretical knowledge. Practical scores were obtained from a clinical practice examination, which covered urological nursing practices such as bladder irrigation, drainage bag replacement, urinary catheter placement, enema administration, and more. Additionally, the examination included the handling of emergency situations. Senior nurses who did not participate in the research established a simulation scenario for an emergency situation, and students independently solved the related problems. The clinical practice examination was also scored out of 100 points. Three senior nurses from the urology department independently graded the students' operational skills, and the average score was used as their final practical score. Higher scores indicated better mastery of professional competence.

Evaluation of Creative Thinking

The Marmara Creative Thinking Dispositions Scale (MCTDS), developed by Özgenel and Çetin (2017) with a Cronbach's α of 0.87, is widely used to assess creative thinking in nursing education (Molu and Baş, 2024). It consists of 25 items and 6 sub-dimensions (innovation search, courage, self-discipline, inquisitiveness, doubt, and flexibility). All items are rated on a five-point Likert-type scale, with a total score of 125 points. A higher score indicates a stronger ability in the respective dimension. MCTDS was administered to students before and after the training.

Evaluation of Critical Thinking

Critical thinking was evaluated using the California Critical Thinking Skills Inventory-Chinese Version (CTDI-CV) (Yeh, 2002). The tool contains 7 subscales: truth-seeking, analyticity, open-mindedness, systematicity, inquisitiveness, confidence in reasoning, and maturity in judgment. Each subscale contains 10 items rated on a six-point Likert-type scale. The total score is 420 points, with a higher score indicating a better level of critical thinking. The overall Cronbach's α of the CTDI-CV was 0.90 (Kang et al, 2021). The CTDI-CV was administered before and after the training.

Satisfaction With Teaching Evaluation

Students' satisfaction with teaching was assessed using questionnaires. The questionnaire consists of two aspects: the form and effectiveness of teaching. For the teaching form, it included five questions that primarily inquired about students' satisfaction with the teaching model, teaching content, teaching arrangement, teacher-student communication, and examination methods. Each question was scored out of 10 points, with a total score of 50 points. The assessment of teaching effectiveness consisted of five questions, focusing on students' satisfaction with the improvement of professional competence, self-reflection ability, self-directed learning ability, problem-solving ability, and communication with patients. Each question was

Table 1. The general information of two groups.

General information	Control group (n = 45)	Study group (n = 40)	χ^2/t	p
Age (Years)	22.56 ± 1.36	22.70 ± 1.52	0.448	0.655
Gender, n (%)			0.119	0.730
Male	8 (17.8%)	6 (15.0%)		
Female	37 (82.2%)	34 (85.0%)		
Nursing course grades, n (%)			0.441	0.802
Excellent	6 (13.3%)	4 (10.0%)		
Good	24 (53.4%)	24 (60.0%)		
Pass	15 (33.3%)	12 (30.0%)		

also scored out of 10 points, with a total score of 50 points. Higher scores indicated higher satisfaction with the teaching.

Statistical Analysis

Statistical analysis was performed using SPSS 24.0 (SPSS, Chicago, IL, USA). The measurement data with normal distribution detected by Shapiro-Wilk test are expressed as $\bar{x} \pm s$, and t-test was used to compare the differences between two groups. The count data was displayed with a rate (%). Chi test was used to analyze the differences between two groups. The $p < 0.05$ indicated a significant difference.

Results

General Information

The control group consisted of 8 males and 37 females, with an average age of 22.56 ± 1.36 years. The study group had 6 males and 34 females, with an average age of 22.70 ± 1.52 years. There were no statistically significant differences in age, gender, or nursing course grades between the two groups ($p > 0.05$, Table 1).

Comparison of Professional Competence Between Two Groups of Students

Professional competence is evaluated using theoretical and practical scores. There was no significant difference in theoretical and practical scores between the control and study groups before training ($p > 0.05$). After training, the theoretical and practical scores were significantly higher in both groups compared to before the training ($p < 0.05$), suggesting that both teaching models improved theoretical and practical performance. Furthermore, the theoretical and practical scores were higher in the study group than in the control group after training ($p < 0.001$) (Table 2). This indicates that the combination of flipped classroom and IMB effectively improved theoretical and practical scores in urological nursing education, with better results than the flipped classroom model alone.

Comparison of MCTDS Score Between Two Groups

There was no significant difference in MCTDS scores between the two groups before training ($p > 0.05$). After training, the total MCTDS score and scores in the five dimensions were higher in both groups compared to before training ($p <$

Table 2. Comparison of theoretical score and practical score between two groups ($\bar{x} \pm s$).

Group	Theoretical score		Practical score	
	Before	After	Before	After
Control group (n = 45)	50.22 ± 7.31	80.33 ± 10.29*	45.22 ± 5.33	75.67 ± 8.90*
Study group (n = 40)	51.50 ± 4.81	89.78 ± 8.45*	44.23 ± 3.75	85.23 ± 9.22*
t	0.941	4.592	0.979	4.860
p	0.350	<0.001	0.331	<0.001

Note: *$p < 0.05$ compared with before.

Table 3. Comparison of MCTDS score between two groups ($\bar{x} \pm s$).

MCTDS scale		Control group (n = 45)	Study group (n = 40)	*t*	*p*
Self-discipline	Before	13.09 ± 3.54	14.08 ± 4.55	1.126	0.263
	After	18.69 ± 2.39*	21.68 ± 2.22*	5.952	<0.001
Innovation search	Before	24.60 ± 2.89	25.10 ± 3.33	0.741	0.461
	After	31.09 ± 3.34*	33.78 ± 3.56*	3.593	<0.001
Courage	Before	12.16 ± 3.08	12.60 ± 2.12	0.758	0.451
	After	15.22 ± 2.54*	17.03 ± 2.08*	3.567	<0.001
Inquisitive	Before	9.22 ± 2.14	8.70 ± 2.05	1.140	0.257
	After	11.24 ± 1.58*	12.75 ± 1.60*	4.372	<0.001
Doubt and flexibility	Before	16.02 ± 2.07	16.18 ± 2.00	0.361	0.719
	After	19.29 ± 2.31*	21.68 ± 2.21*	4.859	<0.001
Total MCTDS score	Before	75.09 ± 6.63	76.65 ± 7.09	1.048	0.298
	After	95.53 ± 5.17*	106.90 ± 5.08*	10.203	<0.001

Note: *$p < 0.05$ compared with before. MCTDS, Marmara Creative Thinking Dispositions Scale.

0.05). After training, the self-discipline, innovation search, courage, inquisitive, doubt, and flexibility scores, as well as the total MCTDS score, were higher in the study group than in the control group ($p < 0.001$) (Table 3). These results indicate that the flipped classroom model, whether used alone or in combination with IMB, effectively improved the creative thinking of urological nursing interns, with the combined teaching model showing better results than the flipped classroom model alone.

Comparison of CTDI-CV Score Between Two Groups

There was no significant difference in CTDI-CV scores between the two groups before training ($p > 0.05$). After training, the scores for truth-seeking, analyticity, open-mindedness, systematicity, inquisitiveness, maturity in judgment, and the total CTDI-CV score were significantly higher than those before training in both groups ($p < 0.05$). Compared with the control group, the truth-seeking, analyticity, open-mindedness, inquisitiveness, maturity in judgment, and total CTDI-CV scores were significantly higher in the study group after training ($p < 0.001$) (Table 4). These results suggest that both teaching models improved students' critical

Table 4. Comparison of CTDI-CV score between two groups ($\bar{x} \pm s$).

CTDI-CV scale		Control group (n = 45)	Study group (n = 40)	t	p
Truth-seeking	Before	35.31 ± 4.22	35.50 ± 4.97	0.191	0.849
	After	39.51 ± 3.45*	42.58 ± 4.72*	3.449	<0.001
Analyticity	Before	37.24 ± 2.54	37.00 ± 3.45	0.368	0.714
	After	42.18 ± 3.35*	46.20 ± 5.08*	4.351	<0.001
Open-mindedness	Before	36.11 ± 3.28	36.05 ± 3.96	0.076	0.939
	After	40.73 ± 4.32*	44.45 ± 4.17*	4.028	<0.001
Systematicity	Before	31.29 ± 4.48	31.93 ± 3.60	0.720	0.474
	After	36.49 ± 3.40*	37.55 ± 3.19*	1.477	0.144
Inquisitiveness	Before	33.40 ± 3.77	33.48 ± 3.47	0.101	0.920
	After	36.33 ± 2.68*	41.58 ± 3.43*	7.907	<0.001
Confidence in reasoning	Before	36.49 ± 5.25	36.13 ± 4.32	0.343	0.733
	After	38.18 ± 3.70	39.28 ± 3.44*	1.414	0.161
Maturity in judgment	Before	34.18 ± 4.72	36.08 ± 4.23	1.945	0.055
	After	40.18 ± 3.85*	45.33 ± 3.63*	6.323	<0.001
Total CTDI-CV score	Before	244.02 ± 9.65	246.15 ± 9.43	1.027	0.308
	After	273.60 ± 9.90*	296.95 ± 9.06*	11.293	<0.001

Note: *$p < 0.05$ compared with before. CTDI-CV, California of Critical Thinking Skills Scale-Chinese version.

Table 5. Comparison of teaching satisfaction between the two groups ($\bar{x} \pm s$).

	Control group (n = 45)	Study group (n = 40)	t	p
Form	40.20 ± 5.23	44.55 ± 4.87	3.953	<0.001
Effectiveness	39.07 ± 4.79	46.08 ± 4.91	6.656	<0.001

thinking, with the improvement being more significant in the IMB combined with flipped classroom model than in the flipped classroom model alone.

Comparison of Teaching Satisfaction Between Two Groups

The students' satisfaction with both the teaching form and effectiveness was higher in the study group than in the control group ($p < 0.001$) (Table 5). This suggests that the combination of IMB and flipped classroom teaching resulted in higher teaching satisfaction compared to the flipped classroom teaching model alone.

Discussion

The number of patients in urology is relatively large, and the types of diseases are diverse, making nursing in this field complex and requiring highly specialized and practical knowledge (Marley et al, 2020). Additionally, patients in urology are often poorly informed about their disease and surgical procedures, and they may have psychological barriers, which further complicates nursing care (Claeys et al, 2021; Foster et al, 2023). Although nursing interns have learned systematic nursing knowledge, they often lack specialized knowledge and clinical practice experience. Therefore, standardized training is essential for nursing students. Previous studies

have reported the positive effects of flipped classroom teaching on urological nursing education (Akcali and Tastan, 2023; Sullivan, 2022). However, other studies have noted the challenges associated with using flipped classrooms, such as lack of motivation for self-directed learning, boredom with self-study of large amounts of material, perceived added workload, and insufficient scaffolding to support self-study (Jovanović et al, 2017; Lai et al, 2021; Tomas et al, 2019). Our study showed that when the IMB model was combined with a flipped classroom teaching method in urological nursing education, it improves teaching effectiveness and high student satisfaction. We noted significantly enhanced students' theoretical and practical scores, critical thinking, and creative thinking.

IMB theory suggests that behavioral patterns are changed and maintained by leveraging information, motivation, and behavioral interventions, which have primarily been used in the development of individual health models (Li and Zhu, 2022; Tsamlag et al, 2020). Information refers to behavior-specific knowledge, motivation involves both personal and social drivers, and behavior includes self-efficacy and objective skills for performing a behavior (Tsamlag et al, 2020). In this study, we applied the IMB-guided flipped classroom teaching model in nursing education. Both theoretical and practical scores were significantly improved in both the control and study groups after training. Additionally, the study group's theoretical and practical scores were significantly higher than those of the control group post-training. These results suggest that students in the study group demonstrated better professional competence than those in the control group. Previous studies have also reported the positive effects of flipped classrooms on professional competence in nursing education (Barranquero-Herbosa et al, 2022; Li et al, 2020), which aligns with our findings. Moreover, combining IMB with the flipped classroom model outperformed the flipped classroom alone. This improvement can be attributed to the IMB intervention in students' motivational behavior (Lee and Kim, 2022; Si et al, 2022). We intervened in terms of student behavior, psychological motivation, and academic status prior to the flipped classroom teaching to help students develop self-directed learning habits and motivation. Throughout the training, teachers were consistently aware of students' learning progress and status, maintained smooth communication, adjusted the teaching plan, assisted students in understanding difficult concepts, and sustained their learning enthusiasm. This approach addressed the common challenges of motivation and self-learning that students often face during flipped classroom teaching.

Creative and critical thinking complement each other and are essential skills for nurses (Taşdelen Baş et al, 2022). Nurses need these skills to develop effective communication with physicians and patients and to recognize and solve problems (Falcó-Pegueroles et al, 2021; Kim and Sim, 2020). These skills can be acquired and enhanced through training (Li et al, 2019; Ma et al, 2018). Critical thinking helps nurses view problems from multiple perspectives, while creative thinking provides innovative solutions (Taşdelen Baş et al, 2022). In this study, we found that the creative and critical thinking abilities of students in both groups improved after training, as evidenced by elevated CTDI-CV and MCTDS scores. Moreover, the students in the study group demonstrated better creative and critical thinking

than those in the control group. The flipped classroom model facilitated independent thinking, which enhanced students' critical and creative thinking skills (Al-Zahrani, 2015; Nichat et al, 2023; Putri et al, 2021). With the addition of IMB intervention, students in the study group developed a positive psychological state and greater motivation for learning, which further supported their problem-solving abilities. Additionally, the training of critical and creative thinking was a key objective of this study. Teachers introduced open-ended questions during behavioral interventions, guiding students to reflect on solutions. These measures also helped students practice and strengthen their creative and critical thinking skills.

Quality of care significantly impacts patient recovery and outcomes. Knowledge and professional nursing skills are key factors influencing the quality of nursing care (Fukada, 2018; Recio-Saucedo et al, 2018). Studies have reported a strong positive relationship between nurses' critical thinking abilities and clinical decision-making in critical care settings (Ludin, 2018). Creative thinking also contributes to improved quality of care and organizational effectiveness in clinical environments (Cheraghi et al, 2021). For instance, when addressing patients' misunderstandings or non-cooperation with nursing care, students in the study group were able to analyze the causes of disputes from multiple perspectives. They considered factors such as the patients' psychological and pathological states, daily diet, family cooperation, collaboration with attending doctors, and communication with other patients. These elements helped them quickly identify potential problems and develop multiple solutions. As a result, patients received better care due to prompt problem-solving and effective communication. In contrast, students in the control group did not perform as well as those in the study group. While we did not collect patient evaluations or satisfaction regarding the nursing quality provided by interns, it is evident that the nursing skills and problem-solving abilities of the interns significantly improved during clinical practice, leading to higher patient satisfaction. Unfortunately, we were unable to determine if there was a difference in patient satisfaction between the two groups, which could be a topic for future research.

Our study demonstrated that the IMB combined with the flipped classroom teaching model resulted in higher teaching satisfaction in both form and effectiveness. This can be attributed to the IMB model's ability to help students develop motivation for independent learning. Additionally, teachers provided timely interventions regarding students' learning progress before and after lessons, addressing both professional skill development and psychological well-being. As a result, students participated in nursing internships with a more relaxed mindset, leading to greater satisfaction with the teaching process.

This study was not randomized due to its retrospective nature. The participants were third-year nursing students who had already completed the theoretical learning and assessments for their nursing major. The general demographic characteristics of both groups did not differ significantly. The teaching of theoretical knowledge was conducted using traditional, teacher-centered methods, where students passively received this knowledge. While the approach to acquiring knowledge and the content delivered were consistent, potential factors may influence the findings of our study, such as the family education, their prior learning experiences,

and personality differences. Therefore, future studies should employ randomized prospective designs to account for these variables.

One limitation of this study is the small sample size, and the fact that participants were nursing interns. It remains unclear whether this teaching method can be generalized to other nursing education contexts or applied to different fields. There is also a lack of similar studies for comparison. Potential factors, such as differences in knowledge, teaching objectives, teacher resources, student characteristics, and cultural differences, may affect the teaching effectiveness and broader applicability of the IMB combined with flipped classroom model. Future research could consider expanding the sample size and exploring the application of this model in other nursing education settings.

Additionally, the long-term effects of this teaching model on nursing students warrant further investigation. Longitudinal studies should be designed to track whether there is a correlation between teaching modes and the career development of nursing interns. It is also important to note that the IMB combined with flipped classroom model requires more educational resources compared to traditional teaching methods. The increased economic costs should be considered when evaluating the applicability and scalability of this model in different cultural and educational contexts. A cost-benefit analysis would be valuable for assessing the efficiency of the model and guiding the optimal use of educational resources.

Conclusion

In conclusion, the combination of the IMB model with the flipped classroom teaching method in urological nursing education demonstrated strong teaching effectiveness and high satisfaction. This approach significantly enhanced students' theoretical and practical scores, critical thinking, and creative thinking. The findings of this study offer valuable insights for improving teaching and learning outcomes in nursing education and provide innovative strategies for advancing nursing practice education.

Key Points

- The effectiveness of flipped classroom teaching can be hindered by a lack of motivation and self-directed learning habits. However, the IMB-guided flipped classroom model has proven to be effective in addressing these issues, leading to significant improvements in the theoretical and practical performance of urological nursing interns.
- The IMB model enhances the learning behavior of urological nursing interns through a comprehensive approach involving information intervention, motivation intervention, and behavioral intervention. This three-pronged strategy progressively improves their learning outcomes.
- The combination of IMB and flipped classroom teaching significantly enhances the critical and creative thinking skills of urological nursing interns, which are essential for their professional development.
- The IMB combined with the flipped classroom teaching model results in higher teaching satisfaction among students compared to the flipped classroom model alone, as it addresses both academic and psychological aspects of the learning process.

Availability of Data and Materials

All data included in this study are available from the corresponding author upon reasonable request.

Author Contributions

SZ and CYC designed the research. SZ and HJW performed this study and collected all data. SZ and HJW analyzed the data. SZ and CYC wrote the first draft. All authors contributed to the important editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

This study was approved by the ethics committee of Wenzhou People's Hospital (Approval Number: KY-202406-002) and complied with the Declaration of Helsinki. All participants were informed and agreed to participate in the study.

Acknowledgement

Not applicable.

Funding

This research received no external funding.

Conflict of Interest

The authors declare no conflict of interest.

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