ORIGINAL RESEARCH

The Influence of Online and Offline Mixed Teaching Mode Based on TPACK on the Theoretical Knowledge and Comprehensive Ability Level of Tumor Gynecology Postgraduates

Lihua Wang, MM, Caizhi Wang, MM, Beibei Wang, MM, Rong Zhang, MM, Liangliang Wang, MM

ABSTRACT

Aim • To explore the influence of online and offline mixed teaching modes based on TPACK on theoretical knowledge and comprehensive ability of tumor gynecology postgraduates.

Methods • In this study, a prospective randomized controlled study model was used to select 60 masters of oncology and gynecology who were interned in the Affiliated Hospital of the First Affiliated Hospital of Bengbu Medical College from September 2019 to April 2022 as the research objects. They were divided into a study group and a control group by random number table, with 30 cases in each group. The control group adopted the traditional teaching mode, while the study group adopted the mixed online and offline teaching mode based on TPACK to implement the teaching. The knowledge mastery, problem analysis ability and total ability of the two groups were compared before and after the practice.

Results • After the practice, the scores of theoretical knowledge, clinical operation skills and case analysis ability of both groups were improved compared with those before the practice, and the scores of the study group were higher than those of the control group ($P < .05$). After practice, the scores of problem analysis and clinical work competence in both groups were significantly higher than those before practice, and the study group was higher than the control group ($P < .05$). After practice, the scores of professional technical knowledge, doctor-patient communication ability, clinical operation skill, disease observation ability and clinical first-aid ability of both groups were improved compared with those before practice, and the scores of the study group were higher than those of the control group ($P < .05$).

Conclusion • In clinical teaching, the online and offline mixed teaching mode based on TPACK has obvious effects on improving the theoretical and clinical operation level of tumor gynecology postgraduates and the total ability of medical staff. (*Altern Ther Health Med.* 2024;30(10):195-199).

Lihua Wang, MM; Beibei Wang, MM; Liangliang Wang, MM; Department of Oncological Gynecology, The First Affiliated Hospital of Bengbu Medical College, Bengbu, Anhui, China. **Caizhi Wang, MM; Rong Zhang, MM;** Department of Obstetrics Gynecology, The First Affiliated Hospital of Bengbu Medical College, Bengbu, Anhui, China.

Corresponding author: Liangliang Wang, MM
E-mail: wangliangliang1024@163.com

INTRODUCTION

In today's society, due to the influence of lifestyle and environment, the incidence of gynecological tumor-related diseases is increasing.[1] The treatment of gynecological tumors also changes with the development of scientific and technological information and the needs of patients.[2,3] Therefore, clinicians need to establish a professional medical team. Hospitals and medical colleges pay more and more attention to the training of professional graduate students through practical and systematic knowledge education and training practical clinicians.[4,5] Traditional medical education is based on 'teaching' as the main clinical teaching mode, which can not meet the training requirements of practical physicians.[6,7] In recent years, the training mode of practice for professional postgraduates has changed.[8] Industries are facing enormous challenges in the context of the novel coronavirus pneumonia epidemic. The traditional offline teaching mode of oncology postgraduates in hospitals is also challenged, and the introduction of online teaching has become a hot topic in colleges and universities.[9,10] Relevant departments encourage educational institutions or training institutions to carry out teaching and training through new models. For example, within the school, teachers will use nails, superstar learning, and education cloud platforms to complete teaching tasks, which not only enriches the classroom content but is also convenient and fast.[11,12] For hospitals, the master's degree or internship in hospitals needs to conform to the national standardized training policy for residents, which is also the key to the cultivation of clinical

Table 1. Baseline data of the two groups of subjects

Items	Study group (n = 30)	Control group (n = 30)	t/χ^2	*P* value
Age (years old)	24.1±1.3	24.3±1.2	-0.619	.538
BMI (kg/m^2)	23.18±1.80	23.30±2.01	-0.244	.808
Gender (%)			0.162	.688
Male	4(13.33)	3(10)		
Female	26(86.67)	27(90)		

practice literacy.[13] Technological pedagogical content knowledge (TPACK) is a theory based on pedagogical content knowledge (PCK). Some countries have carried out meticulous thinking and analysis on it. The viewpoint mainly focuses on the measurement of the level of subject teaching knowledge of teachers' integrated technology and the development strategy of the level of subject teaching knowledge of teachers' integrated technology. There are few studies on the effect of this model on the training of medical postgraduates.[14] In the severe medical environment, a new teaching mode began to enter the clinic.[15] Based on the above research background. This study focused on online and offline teaching practice activities in gynecological clinical teaching activities during the epidemic. It explored the effect of online and offline mixed teaching modes based on TPACK in clinical teaching of gynecological oncology and the improvement of the comprehensive ability of graduate students.

DATA AND METHODS

General information

A prospective randomized controlled study was conducted to select 60 masters of oncology gynecology who practiced in the First Affiliated Hospital of Bengbu Medical College from September 2019 to April 2022. The random number table generated by SPSS21.0 software was used. All students were divided into study groups and control groups, 30 cases in each group, and the basic situation of the two groups of students was compared ($P > .05$). See Table 1

Inclusion criteria: (1) All the graduate students included in this study are the students enrolled in our college through the national postgraduate entrance examination. (2) The age range of students is 23-26 years old. (3) All graduate students strictly abide by the relevant provisions of this study. (4) The study protocol conforms to medical ethics.

Exclusion criteria: (1) Non-tumor gynecology graduate students. (2) Students who dropped out of the study.

Teaching method

Control group: teaching physicians according to the training objectives, teaching journals and lesson plans to explain the theoretical knowledge, through questioning students to grasp the situation, leading interns ward round, through the actual investigation to understand the entire medical process.

The research group adopted a TPACK-based online and offline blended teaching model: integrating multidisciplinary knowledge centered on TPACK. Make full use of the online platform, and upload course plans and teaching materials so that students can learn independently. Set up a Q&A column where students can ask questions, and both teachers and students can participate in answering to collectively address knowledge-related challenges. In offline teaching, the imaging department led the students to explain the patient's medical history and imaging data, combined with the students' professional mastery. Subsequently, the internship graduate students discussed in groups to understand and summarize the problems in the diagnosis and treatment of the disease. Finally, a case of imaging diagnosis and related pathology, anatomical basis and pathogenesis, diagnosis and treatment programs and other systematic knowledge were summarized, and PPT report was prepared, teaching physicians to comment and correct. The attending doctor led the interns to ward rounds. In this process, the interns played the main role and studied the specific cases. Using digital stereo model to show interns three-dimensional graphics of the tumor, intuitive understanding of anatomical characteristics. Through the supplement of online theoretical knowledge and the exploration of offline solid models, internship postgraduates acquire certain professional content. According to the content of the case, simulate the medical treatment process, show the ability of medical history collection, physical examination, disease analysis, case writing and doctor-patient communication skills. Through the group, members to perform the medical process and experience the current situation of patients. The group leader made PPT to summarize the report, display the learning results, and comment by the teachers, point out the shortcomings and put forward the improvement measures.

Criteria for evaluation

The evaluation of the mastery of relevant knowledge and the analysis ability of the problem is mainly based on knowledge mastery: students are evaluated before and after the internship, mainly by using the same test paper to evaluate the students' knowledge mastery, mainly from the students' theoretical knowledge, students' clinical operation skills, case analysis ability three aspects to evaluate, each aspect of the full score is 50 points, the higher the score, the better the students' knowledge mastery.[16] The evaluation of students' problem analysis ability and competence was evaluated by the Chinese version of the critical thinking disposition inventory (CTDI-CV). The response level of each question was divided into 6 grades, with a full score of 60 points. The strength of students' analysis ability was positively correlated with the total score.[17] Competency using hospital self-made competency assessment scale evaluation, including work attitude, professional knowledge and general ability, the full score of 100 points, the stronger the competency of medical staff, the higher the score.[18]

The total ability score of medical staff was evaluated by a self-made questionnaire from nine dimensions: professional and technical knowledge, doctor-patient communication ability, empathy ability, innovative thinking ability, clinical operation skills, disease observation ability, learning and scientific research ability, clinical emergency response ability

and psychological resilience ability. A total of 22 questions were investigated, and the score range of each question was 1-5 points. The average score of each question was calculated as the dimension score. The higher the score, the stronger the ability of the medical staff.

Statistical processing

SPSS21.0 processed the data. a significance level of 0.05 was set, measurement data conforming to normal distribution were expressed as ($\bar{x} \pm s$), and a t test was performed. Count data rates were expressed, and χ^2 tests were performed. $P < .05$ indicated that the difference was statistically significant.

RESULTS

Comparison of theoretical knowledge, operational skills and case analysis level between two groups of students

The theoretical knowledge, clinical operation skills and case analysis ability of the two groups of postgraduates were evaluated before the internship. The scores of the two groups of students in the above three indicators were compared ($P > .05$). After the internship, the evaluation was carried out again. The theoretical knowledge level of the students in the study group was significantly improved, the students' clinical operation skills were more skilled, and the comprehensive level of case analysis ability was significantly improved. The scores of the three indicators were higher than those of the control group ($P < .05$). In other words, the hybrid online and offline teaching model based on TPACK can improve students' professional competence more effectively. See Table 2

Comparison of Problem Analysis Ability and Competency Evaluation of Two Groups of Graduate Students Before and After Practice

Before the internship, there was no significant difference between the two groups in problem analysis and clinical work competency ($P > .05$). After the internship, the students in the study group had significantly improved their ability to analyze problems and their competence in clinical work. The scores of the two indicators were higher than those of the control group ($P < .05$). See Table 3

Comparison of total ability scores of medical staff between two groups of students

Before the internship, the study group and the control group of patients with professional and technical knowledge, doctor-patient communication skills, empathy ability, innovative thinking ability, clinical operation skills, disease observation ability, learning ability, clinical emergency ability, resilience ability score were compared ($P > .05$). After practice, the scores of professional technical knowledge, doctor-patient communication ability, clinical operation skill, disease observation ability and clinical emergency ability in the study group were higher than those in the control group ($P < .05$). See Table 4

Table 2. Comparison of theoretical knowledge, operational skills and case analysis level between two groups of students ($\bar{x} \pm s$, scores)

Groups	n	Theoretical knowledge		Students' clinical operation skills		Case analysis ability	
		Before practice	After practice	Before practice	After practice	Before practice	After practice
Study group	30	29.61±5.58	42.74±4.89	25.80±4.41	43.08±5.11	33.08±3.90	41.64±4.70
Control group	30	30.83±5.77	40.02±4.63	26.75±4.84	40.33±4.89	34.41±4.39	38.23±4.90
t		-0.832	2.212	-0.795	2.130	-1.241	2.751
P value		.409	.031	.430	.037	.220	.008

Table 3 Comparison of problem analysis ability and competency evaluation of two groups of graduate students before and after practice ($\bar{x} \pm s$, scores)

Groups	n	Problem analysis ability		Competency	
		Before practice	After practice	Before practice	After practice
Study group	30	36.10±6.02	48.19±7.05	69.53±10.01	86.83±7.74
Control group	30	34.78±5.84	44.07±6.76	67.75±8.95	82.08±8.51
t		0.862	2.310	0.726	2.262
P value		.392	.024	.471	.027

Table 4. Comparison of total ability scores of medical staff between two groups of students ($\bar{x} \pm s$, scores)

Groups	n	Specialized technical knowledge		Doctor-patient communication ability		Empathy ability	
		Before practice	After practice	Before practice	After practice	Before practice	After practice
Study group	30	3.11±0.85	4.38±0.55	3.36±0.69	4.20±0.51	3.76±0.70	4.15±0.78
Control group	30	3.24±0.79	4.05±0.57	3.42±0.65	3.88±0.64	3.59±0.68	4.08±0.74
t		-0.614	2.282	-0.347	2.142	0.954	0.357
P value		.542	.026	.730	.036	.344	.723

Groups	n	Innovation thinking		Clinical operation skill		Disease observation ability	
		Before practice	After practice	Before practice	After practice	Before practice	After practice
Study group	30	3.86±0.70	4.38±0.58	2.87±0.84	4.26±0.90	3.11±0.58	4.28±0.75
Control group	30	3.73±0.66	4.14±0.70	2.94±0.81	3.78±0.84	3.24±0.62	3.84±0.82
t		0.740	1.446	-0.329	2.136	-0.839	2.169
P value		.462	.154	.744	.037	.405	.034

Groups	n	Learning scientific research ability		Clinical emergency response capability		Psychological resilience ability	
		Before practice	After practice	Before practice	After practice	Before practice	After practice
Study group	30	3.41±0.50	3.72±0.61	2.97±0.73	4.24±0.62	2.70±0.63	3.74±0.77
Control group	30	3.28±0.55	3.60±0.68	3.10±0.81	3.80±0.69	2.81±0.66	3.58±0.80
t		0.958	0.719	-0.653	2.598	-0.660	0.789
P value		.342	.475	.516	.012	.512	.433

DISCUSSION

In order to meet the needs of medical development, the Ministry of Education and the National Health and Family Planning Commission began to pilot a professional degree-based postgraduate training model. In order to cultivate medical talents with noble medical ethics and strong professional ability for the country.[18] With the renewal of the medical concept, clinical teaching gradually transits to a 'patient-centered' mode. Gynecological oncology patients will experience a series of physiological and psychological discomforts after admission, which is not conducive to the development of treatment and prognosis recovery.[19,20] The Internet has been widely used in the field of teaching and training, but the domestic medical teaching model is mainly face-to-face and offline. In the sudden impact of the epidemic, some hospitals have broken through the routine and adopted online teaching methods to solve the educational problems under the epidemic and promote the reform of teaching

models.[21,22] In this context, a series of measures have been taken in various fields to refine teaching methods. The internship hospital of medical students undertakes the task of teaching and internship for medical students. Under the special situation of the current epidemic, in order to successfully complete the internship training plan for medical postgraduates, new training methods are needed. In this form, the online and offline hybrid teaching reform model is imperative.[23-25]

This study is based on the influence of TPACK's online and offline mixed teaching mode on the theoretical knowledge and comprehensive ability of tumor gynecology postgraduates. The results of this study showed that after the internship, the theoretical knowledge, clinical operation skills, and case analysis ability of the study group significantly improved compared with the control group. Based on TPACK, the online and offline mixed teaching model focuses on the experience of postgraduate internships and plays its main role in learning. This model makes full use of the rich resources of the teaching platform.[26] The teacher completes the transmission of learning materials, the arrangement of preview characters and the preparation of after-school exercises online, improves the theoretical system and professional framework and provides a professional knowledge base for offline teaching. In offline teaching, the internship students are the main body, and the specific cases are studied and explored.[27] Such as teaching physicians with the help of a three-dimensional model for students to grasp the anatomical structure of the lesion, but also talk about the lesion extracted from the view alone so that interns have a detailed understanding of the anatomical structure, improving the ability to case analysis. Supplementing online theoretical knowledge and offline training is helpful to improve problem analysis ability and competency. Studies have pointed out that,[28,29] the combination of online and offline teaching is conducive to improving learning enthusiasm, promote the transformation of clinical thinking. In practical operation, the theory can be infiltrated to improve the operation level. Combined with the results of this study, the online and offline mixed teaching mode based on TPACK realizes the organic combination of online and offline teaching and improves the theoretical level and skill operation ability of interns.

The results of this study showed that, after the internship, the problem analysis ability and competency of the study group were significantly higher than those of the control group. It is suggested that the online and offline mixed teaching mode based on TPACK is conducive to improving the problem analysis ability score and competency score of internship postgraduates. In this mode, online teaching can break through the limitations of traditional teaching materials and strengthen the lead-in teaching so that interns in the break on the learning tasks, can fully mobilize their enthusiasm for learning so that students from passive learning into active learning. Offline teaching is reflected in the use of some experimental methods and experimental techniques to solve the problems encountered in clinical practice. In offline teaching, the improvement of skills is deepened through scenario simulation and display reports, and teaching resources are transformed into learning results. The study found that,[30,31] the guiding force of teaching physicians to enhance the ability of students is very important. Teachers should actively guide interns to learn and practice so that the knowledge from clinical and clinical returns, so that graduate students have interest and confidence in clinical work. The role-based performance can fully demonstrate the spirit of teamwork. This innovation has mobilized the enthusiasm and initiative of interns. In short, the online and offline mixed teaching mode based on TPACK should not only pay attention to the study of clinical professional knowledge but also pay attention to the training and cultivation of skills and mastering excellent clinical skills so as to improve the problem analysis ability score and competency, and become a qualified high-level applied medical talents.

The cultivation of high-quality medical talents is no longer limited to the simple superposition of knowledge and skills. Still, it needs to obtain excellent doctor-patient communication, disease observation ability, innovative thinking, empathy and other abilities, which is also unable to be given by the traditional education model.[32,33] The online and offline mixed teaching mode based on TPACK overcomes a major problem in clinical education and improves the practicality, flexibility and systematicness of teaching content. The results of this study showed that before practice, the scores of professional and technical knowledge, doctor-patient communication ability, empathy ability, innovative thinking ability, clinical operation skills, disease observation ability, learning and research ability, clinical emergency ability, and resilience ability of the two groups were compared ($P > .05$). After the internship, the scores of the study group in professional technical knowledge, clinical operation skills, doctor-patient communication ability, disease observation ability, and clinical emergency response ability were higher than those of the control group. The online and offline mixed teaching mode based on TPACK is not simply to put some offline courses directly on the Internet but to organically integrate online teaching with offline teaching, which better stimulates students' adaptability and self-control, and students can complete online teaching tasks on time.[34] Online can first discuss the case, summed up the etiology, molecular mechanism, diagnosis and identification, treatment principles and prognosis evaluation. Then, bring the above knowledge to the offline teaching process and consolidate it when following the teaching physician. In addition, the teaching physicians also asked the internship graduate students to demonstrate the whole medical process and simulation of medical events. The online and offline mixed teaching mode based on TPACK focuses on training students' clinical skills and creating more clinical practice opportunities for them. Using scientific methods to guide practice, improve the ability to solve practical problems,

improve professional technical knowledge, clinical operation skills, disease observation ability, and clinical emergency response-ability. Through offline internships, patients and their families are carefully listened to with a gentle tone and patient attitude, and comfort words are used to make them have a basic expectation of the severity of the disease so as to achieve a harmonious coexistence between doctors and patients and improve the communication ability between doctors and patients.

According to a study,[35] some hospitals have launched a new model of teaching for interns, realized resource sharing and complementary advantages, which is conducive to the cultivation of high-quality applied talents of specialist doctors in schools and promotes the comprehensive development of medical and scientific research work. The introduction of the new teaching mode is both an opportunity and a challenge. The online and offline mixed teaching mode based on TPACK condenses the essence and mode of various disciplines, which has a significant role in promoting doctor-patient communication, tumor diagnosis and treatment and subject communication. It is an effective way to train medical interns.

In summary, in clinical teaching, the online and offline mixed teaching mode based on TPACK has an obvious effect on improving the theoretical and clinical operation level of obstetrics and gynecology postgraduates and the total ability of medical staff. Due to the small sample size and short study time in this study, there may be some bias in the study results. In the future, the sample size can be increased, the study time can be extended, and further research can be conducted to provide a clinical basis.

CONFLICT OF INTEREST

The authors reported no potential conflict of interest.

DATA AVAILABILITY STATEMENT

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

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