

# Practical Application and Students' Abilities Assessment of Blended Teaching in Breast Oncology Department Clinical Internship

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**Abstract:** Objective Blended teaching has become the hot spot and advanced direction of educational reform, but there is little experience of blended teaching in clinical medicine internship courses. Besides, there is a lack of student ability assessment with empirical data supporting it in this research field, where our study aims to fill the gap. Methods We organized and implemented blended teaching in the breast oncology department for the class 2018 students' clinical internship course by establishing and providing an online database. We collected student feedback through questionnaires and combined it with their comprehensive assessment results and teacher evaluations to jointly analyze and evaluate the improvement of students' abilities. Results This study effectively collected 137 questionnaires, of which 55 were from males (40.1%). The study found that the introduction of blended teaching could better solve many problems in breast oncology department clinical internships, avoid patient privacy issues, break the limitations of time and space, and expand the depth and breadth of students' learning. Students had large and persistent demands for learning resources, and some even increased during the clinical internship, which indicated that blended teaching was conducive to improving students' independent learning abilities. At the same time, students were satisfied with the online database which improved their learning effectiveness and clinical internship experience. Various data showed that incorporating blended teaching into clinical internships enhanced students' core clinical competencies. Conclusion This practice fills the shortcomings of existing research and has positive reference significance for promoting the deepening development of blended teaching and the reform of internship courses.

**Keywords:** Clinical Internship, Breast Oncology Department, Blended Teaching, Ability Assessment

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## 1. Introduction

The continuous development of modern information technology has profoundly influenced and transformed the education mode for universities under the background of "Internet Plus". The concept of blended teaching, which combines both online and offline instructional methods, has become a hot point and an advanced direction for educational reform in higher education institutions [1-3]. However, to date, there is still a lack of practical experience in using the blended teaching method in clinical internship courses, with most

research only focusing on improving students' academic performances rather than assessing their progress in professional skills, which is potentially more important at current stage [4, 5]. Additionally, although students' satisfaction has been given careful consideration, the insufficiency of supporting data remains a weakness in validity assessment within this research area [6]. As clinical teachers in the breast oncology department, they are faced with numerous challenges, including the need for patient privacy protection, the intricacy of disease diagnosis and treatment procedures, as well as the limitation of teaching time

in the clinical internship processes, which make education reform urgently needed in this field to improve the teaching efficiency and education quality. In this study, we proposed the implementation of the blended teaching model during students' clinical internships in the breast oncology department, attempting to find a solution to the dilemmas as abovementioned. What's more, considering the weaknesses in the existing research, we conducted a comprehensive and scientific assessment of students' competency improvement. We expect that this study could provide a valuable reference experience for improving the blended teaching evaluation system and deepening the teaching reform of clinical internship courses.

## 2. Study Population and Methods

### 2.1. Study Population

In this study, we selected undergraduate students who entered the university in 2018 and were majoring in clinical medicine as the study population. They were given access to an online database called "Clinical Medicine Internship Courses in the Breast Oncology Department", which assisted them with their learning during their clinical internship in the breast oncology department. The data was collected anonymously using the WeChat applet "Questionnaire Star Small". During the process of data collection, a total of 139 questionnaires were collected, and 2 questionnaires were eliminated owing to uncompleted answers or suspected unreal answers. Therefore 137 effective questionnaires were finally obtained with an efficient rate of 98.6%. The Cronbach's  $\alpha$  coefficient of this scale ranged from 0.93 to 0.96, indicating a high internal consistency reliability. The mean age of participants was  $21.85 \pm 1.65$  years old. Among them, there are 55 males, accounting for 40.1%, and 82 females, accounting for 59.9%.

### 2.2. Methods

#### 2.2.1. Curriculum Design

The optimization of course design is an important step in blended teaching. Blended teaching can be narrowly defined as integrating online teaching grounded in Internet technologies with face-to-face offline teaching. Blended teaching can also be more widely defined as encompassing diverse teaching technologies, teaching places, and teaching methods. Consistent with the principle of precision teaching, we endeavored to develop our curriculum with a scientifically sound design of course content, a logically feasible allocation of teaching materials, and a specific definition of the teaching contents and emphasis on both online and offline teaching to make full advantage of teaching time, enhancing our teaching efficiency. On the other hand, the analysis of historical materials related to theoretical courses and examination results showed that students had mastered most of professional knowledge from their previous studies. Therefore, to avoid repeated teaching of theoretical course knowledge in clinical internship courses, we adopted the problem-based

learning (PBL) teaching method in the clinical internship curriculum design. This pattern of teaching emphasized that students are the subjects of the learning processes, providing them with increased options and independence, and thus effectively stimulating their thirst for knowledge. Moreover, it actively enhanced the depth and breadth of their internships, striving to achieve optimal educational outcomes [7]. Aside from demonstrating necessary operations, teachers should select representative clinical cases, orient to practical problems, and cultivate students' critical thinking and analytical skills. This approach would reinforce students' subjective initiative and improve their ability to apply their acquired knowledge to real-world problem-solving, while also promoting group discussions and team collaboration. Clinical teachers ought to pay attention to culture students' skills in doctor-patient communication and establish their humanistic care consciousness throughout the operational process simultaneously.

At the same time, we have sorted out the necessary content for online teaching. Considering the diverse challenges teachers might face during clinical internship teaching, such as the hardship of finding patients presented typical symptoms of all various diseases, or the rejection of entering and visiting the operation room owing to the standard of sterility, we made a comprehensive summary, which was conducive to make it clear that what teaching materials need preparation in advance. And combined with past teaching experience, we summarized the key points and difficulties in clinical teaching as well as the weak points reflected in students' theoretical examinations to form a preliminary list for teaching resource database that we need to build. Furthermore, acknowledging the fact that textbook knowledge generally falls behind clinical practice, we have included development tendencies and frontiers of breast oncology research field into the database's expansion list. This work enriched online teaching resources and promoted students' independent and in-depth study.

#### 2.2.2. Database Establishment

The core of blended teaching is the utilization and integration of online resources. Rationality, pertinence, comprehensiveness, and scientific are the crucial aspects that need to be ensured in the preparation phase [8]. After searching major online platforms, we founded that teaching resources referring to clinical internships are almost blank. It indicated that we not only required a well-designed curriculum but also needed to construct and organize network resources innovatively to fill this gap. This idea served as a fundamental basis for our blended teaching during clinical internships. Based on the teaching resources database list noted earlier, we collected documentation from both domestic and foreign educational websites, combined with relevant literature resources, and integrated clinical case data and surgical videos collected in daily work to construct the "Clinical Medicine Internship Courses of the Breast Oncology Department" database. The database consisted of three parts: "Typical clinical case picture

database", "Breast surgery videos database", and "Imaging diagnosis database". The "Typical clinical case picture database" contained a total of 51 pictures, which eliminated the mechanism of breast diseases' occurrence, development, molecular subtyping, treatment methods, and so on. As for the "Breast surgery videos database", we selected 8 videos of classic surgical approaches such as modified radical mastectomy, breast-conserving surgery, oncoplastic surgery, and nipple-areola reconstruction surgery. Besides, the "Imaging diagnosis database" included a collection of 5 pictures of 3D composition of breast TOMO imaging. The database is maintained and updated regularly by dedicated personnel. The establishment of this database can better solve problems such as patient privacy issues, difficulty in completing all disease types, expansion of learning content, limited internship time, and so on. The platform provided students with the opportunity to explore and study knowledge independently, no matter before, during, or after their class, forming a multi-dimensional interactive blended teaching model that included teacher-student-platform-resources as well as teacher-student-peers.

### 2.2.3. Data Collection and Evaluation System

Acquiring assessments and feedback is an indispensable part of the blended teaching model. It is of great help to teachers in analyzing the effectiveness of teaching and whether the educational objectives have been achieved [9]. To get student's feedback, we designed and constructed a questionnaire called "Evaluation of the Effects of Clinical Internship Courses in the Breast Oncology Department". The questionnaire includes an evaluation scale section and an open-ended question section. The evaluation scale section was scored by Likert 5-point scale method, with "1" indicating very dissatisfied, "2" indicating dissatisfied, "3" indicating average, "4" indicating satisfied, and "5" indicating very satisfied. While the other section allowed students to give advice and make suggestions freely. Questions in these two sections reconfirm and expand each other, allowing us to collect students' learning effect evaluation and feedback comprehensively and scientifically. Moreover, relevant data could also verify mutual authentication to prevent interference from accidental error checks. The questionnaire includes basic personal information, the educational effect of the clinical internship, the appraisal of blended teaching implementation, personal feelings about the online platform, etc. And the students' comprehensive evaluations, involving teaching implementation, learning experience, ability enhancement, learning resource usage, the platform experience, and so on, are assessed through three dimensions: pre-class preparation, in-class study, and post-class review.

This study adopted SPSS 20.0 software for data statistics and analysis. The categorical data were presented as [ $n$  (%)] and analyzed by chi-square test. Scalar data were expressed as mean  $\pm$  standard deviation ( $\bar{x} \pm s$ ), and  $t$ -tests were performed for analysis accordingly. The threshold for a significant difference was set at  $P < 0.05$ . Additionally, the final internship appraisal adopted a combination of process

evaluation and formative evaluation. The final internship appraisal score consisted of 50% theoretical test score, 10% attendance checks, 10% medical record collection and writing, and 30% practice exam score. Meanwhile, teachers carried out formative evaluations based on the online and offline question-and-answer sessions, classroom presentations, as well as humanistic care consciousness. Relevant data were incorporated in the final teaching evaluation to research, analyze and summarize the impact of blended teaching applications on student ability development.

## 3. Results

### 3.1. The Implementation of Blended Teaching Contributes to Addressing the Challenges Encountered During the Internship in the Breast Oncology Department

Through the preliminary investigation, we found that the clinical internship in the breast oncology department confronted several challenges. The first challenge focused on patients' privacy. Many studies have shown that breast diseases mostly occur in young and middle-aged women. As women's secondary sexual characteristics, breast holds a special place in the minds of most. This concept made it difficult for female patients and their families to accept inspection and palpation, especially when conducted by inexperienced doctors or medical students. Even for male patients, inspection and palpation by medical students may cause embarrassment and discomfort. The second challenge referred to the refinement of disease diagnosis and treatment. Both clinical and foundational breast cancer research are advancing rapidly and updating frequently in knowledge, including molecular subtype, multidisciplinary therapy, and other aspects. What students needed to know ranged from surgical options to chemotherapeutic drugs, from radiation regimens to drug toxicity and side effects, which were so numerous that they hugely increased the difficulty of teaching. As for the third challenge, to fulfil all the teaching tasks within limited time is difficult. There is less teaching time on breast diseases in the theoretical courses of "Surgery" and "Oncology". The internship time for students in the breast oncology department is only about 3 hours. During the subsequent rotation, due to the different development conditions of subspecialties in each teaching hospital, the probability of encountering suitable cases is hard to determine.

The implementation of blended teaching has effectively addressed multiple challenges encountered in breast oncology department clinical internship. Through the preliminary course design, we scientifically planned out the respective focuses of online and offline teaching, compiled a list of data that needed to be improved for database construction, and collected data from multiple aspects and channels. The successful establishment of this database dodges the problem related to patient privacy, avoiding discomfort or embarrassment for both patients and medical students. Besides, the database is enriched with various typical clinical case data, and incorporates learning key points, difficulties, and weak points, and simultaneously updates the cutting-edge knowledge and latest trends in the development of breast

cancer research. All the work strove to preferably enhance the breadth, depth, and richness of students' learning experience.

### 3.2. The Implementation of Blended Teaching Contributes to Enhancing Students' Self-Directed Learning Capabilities

The rapid advancement of modern medicine and the swift renewal of knowledge necessitates medical students to possess powerful self-learning abilities. Otherwise, they may lose their competitiveness in their careers and drop motivation for their sustainable development. That's the reason why we put a high value on cultivating students' autonomous learning capabilities.

Through the feedback obtained from the questionnaire, we found that the top three types of learning resources that students need the most are the specialized disease case practice tests (70.1%), breast surgery videos database (67.2%), and specialty case database (66.4%) before clinical internship, which is also named preview stage. On the other hand, the top three kinds of learning resources that students need most are

specialty case database (80.3%), breast surgery videos database (71.5%), and specialized disease case practice tests (67.9%) during the review stage after the internship. These results implied that students had large and persistent demands for learning resources during the whole process of clinical internship. And the data types they needed remained relatively stable. Additionally, compared with the data we got in the preparation stage, the need for the specialty case database was significantly improved after their internship ( $P < 0.05$ ). Besides, the requirement of breast surgery videos database and communication and Q&A with teachers also increased after the clinical internship, indicating that the integration of blended teaching aroused students' interest in acquiring knowledge referring to clinical problems and facilitated their sense of self-directed learning notably. Students desired to acquire in-depth knowledge of clinical cases, as well as more active discussions with teachers on issues related to disease diagnosis, treatment, and operation, which also reflected the improvement of students' independent learning abilities.

**Table 1.** The types of learning resources desired by students during their internship ( $n=137$ ).

Learning resource types	Before internship $n$ (%)	After internship $n$ (%)
Specialty case database	91 (66.4%)	110 (80.3%)
Breast surgery videos database	92 (67.2%)	98 (71.5%)
Specialized disease case practice tests	96 (70.1%)	93 (67.9%)
Communication and Q&A with teachers	78 (56.9%)	82 (59.9%)
Typical clinical case picture collection	86 (62.8%)	85 (62.0%)

Furthermore, we analyzed students' database usage through questionnaire data. The database was consistently accessible and available for students during the entire process of clinical internship. We found that over half of the students utilized the database for a duration ranging from 30 minutes to 60 minutes (58.4%), which was equivalent to extending their extra-curricular learning by one lesson. Approximately half of the students used the database for previewing before class, during the class, and for reviewing after class, indicating that the database resources were well-suited over the whole process of clinical study. Moreover, this suggested that the application of blended teaching effectively expanded both temporal and spatial dimensions of students' learning. In addition, during the use process, the most used section was breast surgery videos database (73.0%), followed by typical clinical case picture collection (70.1%), and the least frequently used section was communication and Q&A with teachers (35.0%), which manifested that the database resources were more in line with students' actual learning needs and make up for some insufficient parts of clinical internship. These findings also revealed that students' autonomous learning awareness and ability had been strengthened.

**Table 2.** The usage of database ( $n=137$ ).

Details	$n$ (%)
Learning duration	
<30min	23 (16.8%)
30min-1h	80 (58.4%)

Details	$n$ (%)
1h-2h	27 (19.7%)
$\geq 2h$	7 (5.1%)
Usage period	
Preview before class	81 (59.1%)
In class	66 (48.2%)
Review after class	77 (56.2%)
Never	6 (4.4%)
Sections	
Typical clinical case picture collection	96 (70.1%)
Breast surgery videos database	100 (73.0%)
Breast images database	76 (55.5%)
Communication and Q&A with teachers	48 (35.0%)

### 3.3. The Implementation of Blended Teaching Contributes to the Enhancement of Students' Clinical Core Competences

The purpose of medical education is to cultivate qualified medical talents, and its core lies in the formation of clinical competency. Clinical core competencies refer to essential abilities that medical talents must possess to effectively address various challenges encountered in clinical practice, including professional skills, capabilities to provide comprehensive medical care for patients, and communication and collaboration abilities, among others. Hence, we also devoted considerable attention and consideration to this indispensable capability across multiple dimensions analyses.

Firstly, we used the questionnaire to collect students' evaluation of learning effects after applying blended teaching. In the preview stage before class, the typical clinical case

picture collection could help students understand book contents and consolidate knowledge. Meanwhile, the breast surgery videos database assisted them in understanding operative processes, deepening their understanding of anatomy, mastering the principle of tumor-free surgical operations. Besides, it could be a favor for them to know the frontier of breast cancer research development and promote their interest in study. In addition, we contended that the utilization of this platform was conducive for students to arouse their enthusiasm for internship participation and clarify

their learning objectives. Students are satisfied with their evaluation of learning resources and learning effects at each stage and believe that the use of the platform can help increase enthusiasm for internship participation and clarify learning goals. The degree of satisfaction with the connection between the online platform and the offline internship has also attained the "Satisfied" level ( $4.04 \pm 0.67$ ), which suggested that our preliminary course design and resource optimization are reasonable, thereby achieving better learning results for students and enhancing their professional abilities.

**Table 3.** The learning effects of online platform ( $n=137$ ).

Questions	$\bar{x} \pm s$
To what extent do you think the typical clinical case picture collection exerts an influence on your understanding of the book contents in previewing?	$4.34 \pm 0.52$
How much impact do you think the breast surgery videos database has on your understanding of surgical procedures in previewing?	$4.34 \pm 0.63$
To what extent do you think the breast surgery videos database exerts an influence on increasing your interest in learning during the preview?	$4.36 \pm 0.73$
How much influence do you think the online resources exert on promoting your enthusiasm in internship participation?	$4.25 \pm 0.67$
To what extent do you think the typical clinical case picture collection influences consolidating knowledge?	$4.36 \pm 0.62$
How impactful do you think the Breast surgery video database has been in deepening your understanding of anatomy?	$4.37 \pm 0.64$
How much influence do you think the breast surgery video database has on helping you master the principle of tumour-free surgical operations?	$4.36 \pm 0.67$
To what extent do you think the breast surgery videos database exerts an influence on knowing the frontier of breast cancer research development?	$4.18 \pm 0.76$
How much impact do you think the learning platform has on clarifying learning goals?	$4.21 \pm 0.74$
Are you satisfied with the effects of using the online platform in previewing?	$3.94 \pm 0.74$
Are you satisfied with the connections between the online platform and the offline internship?	$4.04 \pm 0.67$
Are you satisfied with the effects of using the online platform during the review?	$4.01 \pm 0.73$
Are you satisfied with the resources available before class?	$4.20 \pm 0.80$
Are you satisfied with the effects of using the online platform to preview?	$4.07 \pm 0.90$
Are you satisfied with the resources available after class?	$4.15 \pm 0.82$
Are you satisfied with the effects of using the online platform for your review?	$4.10 \pm 0.82$

Secondly, students were satisfied with the effectiveness of incorporating blended teaching into clinical internships. The satisfaction score exceeded 4 points in the implementation of teaching, the learning experiences, and the improvement of clinical abilities. Notably, students highly satisfied with the teaching content. They generally believed that blended teaching was very effective in improving clinical thinking ability ( $4.32 \pm 0.71$ ) and enhancing teacher-student interaction ( $4.30 \pm 0.72$ ), whose scores ranked in the top three among all

aspects. Moreover, students fully affirmed the role of this teaching model in enhancing teamwork abilities and ameliorating communication skills with patients. It indicated that the incorporation of blended teaching was beneficial to strengthening their clinical core competences. Additionally, the stimulation of learning interest, increased learning participation, and improved learning initiative were also consistent with our previous research results.

**Table 4.** Assessment of clinical internship teaching effectiveness ( $n=137$ ).

Questions	$\bar{x} \pm s$	Ranking
Are you satisfied with this teaching method?	$4.28 \pm 0.69$	4
Are you satisfied with the provided learning resources?	$4.28 \pm 0.72$	5
Are you satisfied with the teaching content?	$4.31 \pm 0.69$	2
The degree of stimulation in your learning interest	$4.26 \pm 0.78$	7
The promotion of your learning initiatives	$4.15 \pm 0.79$	10
The increments of your learning participation	$4.20 \pm 0.76$	8
The consolidation of your theoretical knowledge	$4.26 \pm 0.72$	6
The enhancement of teamwork skills	$4.12 \pm 0.88$	11
The improvement of teacher-student interaction	$4.30 \pm 0.72$	3
The promotion of clinical thinking ability	$4.32 \pm 0.71$	1
The enhancement of communication skills with patients	$4.20 \pm 0.75$	9

Furthermore, we not only analyzed the questionnaire information obtained from student feedback, but also studied the process evaluation and formative evaluation results provided by teachers. With the integration of blended teaching, students could use the online platform for advanced previewing, leading to clearer learning objectives and stronger

senses of substitution. The classroom presentation was obviously more active than before, and students were more willing to communicate with teachers on clinical-related issues. Moreover, students showed a heightened awareness of humanistic care and privacy protection in the process of contacting patients. Additionally, we analyzed the final

internship appraisal scores across all grades. Compared with other grades, the final internship appraisal score of the Grade 2018 increased significantly after implementing blended teaching ( $P < 0.05$ ). We found that not only did the average score of student increase, but also the individual differences (i.e. standard deviation) decreased. As mentioned previously, the final internship appraisal score encompassed the medical record collection and writing, practice exam score, theoretical test score, and other parts, which aimed at comprehensively assessing students' clinical core competencies. The increase in this score indicated that the application of blended teaching contributed to enhancing students' clinical core competence to some extent.

**Table 5.** The final internship appraisal scores in each grade.

Grades	Average score ( $\bar{x}$ )	Standard deviation (s)	P
Grade 2015	87.67	4.10	<0.001
Grade 2016	85.61	3.50	<0.001
Grade 2017	91.91	3.42	<0.001
Grade 2018	92.59	2.87	-

## 4. Discussion

Based on the constant development of information technology and the constrain imposed by the unique circumstances of the COVID-19 pandemic, we creatively integrated blended teaching into the clinical internship of the breast oncology department. Furthermore, by summarizing our previous experience in clinical internship and integrating it with the findings obtained from existing studies, we have embarked on this highly significant endeavor and exploration. This attempt partially compensated for a shortage of experience in implementing blended teaching in clinical internship courses, offering practical experiences worthy of reference for subsequent reforms in clinical course teaching.

During our implementation of blended teaching, we changed the focus of previous teaching evaluations, emphasizing the assessment of students' abilities improvement, and supported and verified our conclusion through specific data. During the clinical internship process that incorporated blended teaching, students expressed an existing and growing demand for specialized disease case practice tests, breast surgery videos database, and specialty case database. The usage of databases effectively overcame the limitations of time and space during students' clinical internship. Analysis of the data collected from the questionnaires revealed that the database usage expanded students' learning time and fostered their awareness and capacity for autonomous learning. Moreover, this conclusion was mutually confirmed with the stimulation of learning interest, improvement of learning initiative, and increase in learning participation in the subsequent analysis. These findings collectively demonstrated that blended teaching had a positive effect on improving students' autonomous learning abilities. Additionally, according to students' feedback, typical clinical case picture collection helped them to understand book contents and consolidate knowledge. Furthermore, access to the breast surgery videos database enabled them to understand the

operative processes better, deepened their understanding of anatomy, and helped them master the principle of tumor-free surgical operation. It also let them know the development frontier of breast cancer research and promoted their interest in the study. These results fully affirmed the feasibility and significance of incorporating blended teaching in the breast oncology department clinical internship. Moreover, the teaching effect and learning experience improved in clinical internship incorporated blended teaching. Students were satisfied with the teaching implementation, learning experience, and ability improvement, especially in improving their clinical thinking abilities and enhancing teacher-student interaction. In addition, its role in strengthening teamwork abilities and ameliorating communication skills with patients was also fully proven. The data mentioned above jointly indicated that the application of blended teaching significantly enhanced students' clinical core competence. We further analyzed the process evaluation and formative evaluation results provided by teachers, finding that the classroom presentation was more active than before, and students were more willing to communicate with teachers on clinical-related issues. At the same time, students showed more humanistic care and a better concept of protecting patients' privacy in the process of contacting them. Compared with the past years, it was obvious that the final internship appraisal score of the Grade 2018 has been improved, not only in their medical record collection and writing abilities, practice exam scores, and theoretical test scores but also in their clinical core competencies.

We reflected on the limitations of our study. Firstly, the sample size should be further expanded by continuously observing and collecting data from multiple cohorts of students to reinforce the convincingness of the conclusion. Secondly, the evaluation questionnaire needs to be improved urgently, especially the ability assessment scale, which must be supplemented based on drawing on more advanced experience. Thirdly, we need to deepen the development of platform functions, like expanding real-time communication and interaction teacher-student channels and increasing online assessments. Additionally, we prospected the future direction of this research field as follows. The first point is to improve the learning platform continuously. A fully functional and easy-to-use learning platform ensures the success of blended teaching. The suggestions raised by students in the open-ended question section, mainly including enriching academic materials, optimizing website presentation mode, and providing real-time online question-answering capabilities, are the focal points of our future improvement. Also, we will consistently enhance our proficiency in practicing, rethinking, and conducting educational research through daily teaching work, innovating the teaching methods constantly. Meanwhile, we will design and improve our online platform construction based on the demands of students and the latest advancements in education to lay a solid foundation for the information transformation of teaching work. Platform construction should put more consideration on students' needs and provide them with diversified learning resources as much

as possible to meet their learning needs to the greatest extent. The second point is to optimize the curriculum design continuously. Parts that need optimization include facilitating interactive activation of the classroom, providing more hands-on training opportunities for students, enriching learning contents and teaching places, incorporating more clinical cases for interactions and discussions, as well as establishing a seamless connection between online resources and offline practical teaching. During the clinical internship, we should make full use of the extensive clinical case resources to ensure standardized and normative teaching of common cases, as well as to guarantee systematic, integrated, and insightful teaching for complicated cases. Conducting multi-level and interdisciplinary explanations and discussions driven by the diseases, we should aim at cultivating clinicians with well-rounded development and a good sense of professionalism [10]. The third point is to further improve teachers' ability to conduct blended teaching [11, 12]. Teachers should actively engage in peer communication while also regularly reflecting on their teaching conditions to stimulate their intrinsic motivation and subject awareness [13, 14]. Additionally, establish a diversified, procedural, and context-sensitive evaluation system, aiming at facilitating the continuous enhancement of curriculum reform in subsequent teaching practices, thereby facilitating the development of curriculum teaching resources as well as the successful implementation of blended teaching [15, 16]. In brief, there is a need for us to enhance self-improvement, platform construction, and course development, fostering the seamless integration of educators, learners, educational platforms, and resources to build a multiple coexistence, multi-body interaction, and coordination teaching environment [17].

## 5. Conclusions

The integration of blended teaching effectively addressed various challenges encountered in the breast oncology department clinical internship, helped to ensure patient privacy, overcame temporal and spatial constraints, and broadened the scope and depth of students' learning. Moreover, we used specific data to comprehensively evaluate the improvement of students' autonomous learning ability and clinical core competence after blended teaching integration from multiple perspectives. Our study filled the gaps in existing research and had a significant positive reference for the deepening of teaching reform. Nonetheless, this study still faced several limitations that need to be surmounted in further research. For instance, the sample size should be enlarged, and the evaluation questionnaire needs to be further improved. Moreover, the conducting of higher-quality blended teaching in clinical internship courses must be built up based on the empowerment of learning platforms, activation of curriculum design, and expansion of teaching capabilities.

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## Conflicts of Interest

The authors declare no conflicts of interest.

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