

Application Effect of SECI Program in Improving Clinical Nurses' Information Teaching Ability

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Abstract: *Objective:* To investigate the application effect of the SECI theoretical model-based training program in enhancing clinical nursing teachers' information-based teaching capabilities. *Methods:* A self-control study design was adopted, with 124 clinical nursing teachers from a tertiary hospital participating in the SECI training program from January 2024 to June 2025. The program was implemented through four stages: "Establishing Teacher Community (Socialization)", "Case Teaching (Extravagant)", "Integration of Discipline and Research (Fusion)", and "Routine Application of Teaching (Implicit)". Self-designed questionnaires were used to assess teachers' information-based teaching capabilities before and after training, covering four dimensions: awareness and attitude towards information-based teaching, foundational skills, teaching practice, and professional practice. Data analysis was performed using SPSS 26.0. *Results:* Post-training, the total score of clinical nursing teachers' information-based teaching capabilities increased from (53.47 ± 15.56) to (78.92 ± 12.34) , showing statistically significant differences ($t = 15.732, P < 0.001$). Scores in all dimensions also showed significant improvements ($P < 0.05$). Multivariate linear regression analysis revealed that educational background ($\beta = 0.198, P = 0.026$) and professional title ($\beta = 0.184, P = 0.040$) were primary influencing factors for pre-training information-based teaching capabilities, while their impact weakened post-training. *Conclusion:* The training program based on SECI theory effectively enhances clinical nursing educators' digital teaching capabilities. Its structured, spiral-up knowledge transformation process helps bridge competency gaps among teachers from diverse backgrounds, facilitates the mutual conversion and deep integration of tacit and explicit knowledge, and provides a practical new model for developing digital teaching competencies in clinical nursing education.

Keywords: Clinical nursing teachers; Effect evaluation; Information-based teaching ability; SECI model; Training program

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1. Introduction

With the deepening implementation of the "Education Informatization 2.0 Action Plan" and the "National Nursing Development Plan (2021–2025)", the deep integration of information technology with education has become the core driving force for educational reform in the new era^[1]. As a critical component of nursing education,

clinical nursing teaching directly determines the quality of future nursing professionals. Clinical instructors, as primary educators, require strong digital pedagogical capabilities ^[2]. However, research indicates that current digital teaching practices among Chinese clinical instructors face challenges including insufficient emphasis, uneven application distribution, and theoretical-practical disconnection, with widespread issues of superficial understanding, simplistic implementation, and fragmented training ^[3-4].

Traditional training models often focus on isolated skill instruction, failing to systematically enhance teachers' ability to integrate technology into specific teaching scenarios. The SECI Knowledge Transfer Theory Model, proposed by Norichiro Yano, describes a spiral innovation mechanism where tacit and explicit knowledge evolve through four processes: socialization, externalization, combination, and internalization. This model emphasizes knowledge transformation within community interactions and practical contexts, providing a solid theoretical framework for teacher training.

Based on SECI theory, this study aims to construct and implement a systematic training program for clinical nursing teachers, and verify its application effect in improving their information teaching ability, so as to provide empirical basis and strategic reference for the development of clinical nursing education informatization.

2. Data and methodology

Using convenience sampling, we recruited 124 clinical nursing instructors from the neurocritical care unit of a Grade III-A hospital between January 2024 and June 2025.

The inclusion criteria are as follows:

- (1) Hold clinical nursing instructor certification;
- (2) Provide informed consent and voluntary participation.

The exclusion criteria are participants who withdrew during the study period due to leave or resignation. The study was approved by the hospital's ethics committee, and all participants signed informed consent forms.

2.1 Study design

A quasi-experimental design with front-back contrast was adopted.

2.2. SECI training program development and implementation

Based on the training needs revealed by literature analysis and previous questionnaire survey results, the research group constructed a 6-month SECI training program, which is as follows:

- (1) Socialization by establishing a teacher community. The 124 teachers were divided into groups based on teaching styles and interests to form a learning community. Expert teachers initiated thought-provoking questions (such as "What information technology resources can be utilized in nursing skills instruction?") to guide members through brainstorming sessions and experience-sharing, facilitating the transfer of tacit knowledge within the group.
- (2) Explicit through case teaching and discussion. Expert teachers provide exemplary digital teaching cases (such as MOOC videos and micro-lectures), guiding educators to analyze their design concepts, strengths/weaknesses, and technological integration points. Subsequently, teachers independently design teaching materials and present them within groups, undergoing self-evaluation, peer review, and expert feedback. This process transforms individual tacit teaching knowledge into shareable explicit instructional solutions.

- (3) Integration of disciplinary teaching and research by organizing teaching seminars, lesson plan design competitions, and related activities to encourage teachers to systematize and organize their existing explicit knowledge into standardized teaching resource packages (such as digital lesson plan repositories and micro-lecture collections). These resources are then uploaded to platforms like WeChat groups and nursing management systems for sharing, thereby achieving the integration and networking of explicit knowledge.
- (4) Internalization through routine application of teaching by conducting teaching demonstration classes and practical teaching scenarios to create authentic instructional environments. Teachers apply their acquired knowledge to actual teaching practices through the “practice-reflection-improvement” cycle, transforming explicit knowledge into unique, transferable digital teaching competencies. This process achieves a spiral progression in knowledge transformation.

2.3. Evaluation tools and indicators

The evaluation was conducted using the “Clinical Nursing Faculty Information Technology Teaching Competency Questionnaire” independently designed by the research team. Developed based on the “Information Technology Teaching Indicator System for Nursing Majors”, this questionnaire demonstrated good content validity with a Cronbach’s α coefficient of 0.92.

The questionnaire comprises 52 items across four dimensions: awareness and attitudes toward IT teaching (8 items), foundational knowledge and skills (14 items), teaching practice (19 items), and professional practice (11 items). Each item uses a 5-point Likert scale, with total scores ranging from 52 to 260 points. For ease of interpretation, all scores were converted to percentage-based scores. Higher scores indicate stronger capabilities in information technology-assisted teaching.

3. Results

3.1. General situation of clinical nursing teachers and pre-training ability score

This study surveyed 124 clinical nursing educators, with 119 female (95.97%) and 5 male (4.03%). The majority were aged 31–35 (76 participants, 61.29%), had 6–10 years of teaching experience (72 participants, 58.06%), held bachelor’s degrees (78 participants, 62.90%), and were primarily registered nurses (77 participants, 62.10%). Their pre-training information-based teaching competency scores averaged 53.47 ± 15.56 points, with detailed breakdowns across dimensions shown in **Table 1**.

Table 1. Scores of each dimension of information-based teaching ability of clinical nursing teachers before training (n = 124, mean $\pm$ SD)

Project	Number of entries (items)	Score (points)	Article average score (points)
Awareness and attitude towards information-based teaching ability	8	20.86 ± 7.66	2.61 ± 1.18
Basic information teaching and skills	14	38.65 ± 10.38	2.76 ± 1.08
Information-based teaching practice	19	50.33 ± 15.16	2.65 ± 1.08
Information-based vocational practice	11	29.17 ± 8.95	2.65 ± 1.09
Total points	52	53.47 ± 15.56	2.67 ± 1.10

3.2. Single factor analysis of information teaching ability score before training

One-way factor analysis showed (**Table 2**) that the differences in information teaching ability scores of clinical nursing teachers with different ages, teaching years, educational background and professional titles were statistically significant ($P < 0.05$), while the differences between genders were not statistically significant ($P > 0.05$).

Table 2. One-factor analysis of information teaching ability scores before training (n = 124)

Project	Classification	Number of people (%)	Score of information-based teaching ability	Statistic	P
Sex	Man	5 (4.03)	54.38 ± 11.59	t = 0.134	0.894
	Woman	119 (95.97)	53.43 ± 15.74		
Age	25–30 years	11 (8.87)	49.86 ± 21.75	F = 5.629	0.001
	31–35 years	76 (61.29)	50.62 ± 12.10		
	36–40 years	32 (25.81)	62.58 ± 17.59		
	Over 40	5 (4.03)	46.31 ± 14.19		
School age	1–5 years	14 (11.29)	48.13 ± 19.25	F = 4.815	0.003
	6–10 years	72 (58.06)	51.02 ± 11.56		
	11–15 years	32 (25.81)	61.95 ± 18.86		
	15 years and more	6 (4.84)	50.06 ± 15.79		
Record of formal schooling	Junior college education	13 (10.48)	46.66 ± 17.05	F = 4.397	0.014
	Undergraduate course	78 (62.90)	52.00 ± 12.11		
	Postgraduate and above	33 (26.61)	59.62 ± 20.14		
Professional ranks and titles	Nurse	12 (9.68)	57.53 ± 22.57	F = 7.310	0.000
	Primary nurse	77 (62.10)	49.43 ± 10.12		
	Nurse-in-charge	29 (23.39)	58.33 ± 16.25		
	Associate chief nurse or above	6 (4.84)	73.72 ± 29.70		

3.3. Linear regression analysis of influencing factors of information teaching ability before training

Multiple linear regression analysis was conducted using significant variables from the univariate analysis (age, teaching experience, educational background, and professional title) as independent variables. The results showed that educational background and professional title were the main positive influencing factors for information-based teaching ability before training ($P < 0.05$), as shown in **Table 3**.

Table 3. Linear regression analysis of influencing factors of information teaching ability before training

Variable	Method of assignment
Age	25–30 years = 1, 31–35 years = 2, 36–40 years = 3, over 40 years = 4
School age	1–5 years = 1, 6–10 years = 2, 11–15 years = 3, over 15 years = 4
Record of formal schooling	Specialty = 1, undergraduate = 2, graduate and above = 3
Professional ranks and titles	Nurse = 1, nurse assistant = 2, associate chief nurse = 3, deputy chief nurse and above = 4

3.4. Comparison of training effects before and after SECI program

After the training, the total score and each dimension score of clinical nursing teachers' information teaching ability were significantly improved compared with that before the training, and the difference was extremely significant ($P < 0.001$), as shown in **Table 4**.

Table 4. Comparison of information teaching ability scores before and after clinical nursing teacher training (n = 124, mean $\pm$ SD)

Argument	Regression coefficient	Standard error	Standardized regression coefficient	t price	P
Constant	23.869	6.993		3.413	0.001
Age	0.719	2.709	0.031	0.265	0.791
School age	3.303	2.502	0.152	1.320	0.189
Record of formal schooling	5.214	2.309	0.198	2.258	0.026
Professional ranks and titles	4.166	2.009	0.184	2.074	0.040

4. Discussion

The research findings demonstrate that implementing the training program based on the SECI theory has led to a comprehensive and significant improvement in clinical nursing instructors' information-based teaching capabilities ($P < 0.001$, **Table 4**). This outcome fully validates the effectiveness and applicability of the SECI model as a systematic knowledge creation framework in clinical faculty development.

Prior to the training, clinical nursing instructors at our hospital demonstrated moderate-to-low competency in information technology-based teaching (total score 53.47), consistent with findings from Huang et al.^[3]. This reflects the prevalent challenges faced by clinical educators in deeply integrating information technology into teaching practices.

Multivariate linear regression analysis revealed that academic qualifications and professional titles were key determinants of pre-training competencies. Those with higher education degrees and senior professional titles generally exhibit stronger self-directed learning capabilities and richer teaching experience, which provides them with advantages in acquiring, understanding, and initially applying information technology. These findings highlight the uneven development of competencies under traditional training models, potentially leading to a Matthew effect where "the strong get stronger."

The success of the SECI training program lies in its effective resolution of this stalemate. Its effectiveness mechanism may stem from the following aspects:

- (1) The teacher community established during the "socialization" phase creates a safe "field" that stimulates teachers' enthusiasm for sharing tacit teaching experiences and techniques, addressing the issue of "fragmented training";
- (2) Through case study discussions and resource integration during the "externalization" and "integration" phases, experts and core teachers transform their excellent experiences into replicable and disseminated explicit knowledge (such as standardized lesson plans and micro-lectures), providing all teachers with concrete learning models and resource support. This bridges the gap in resource access caused by academic qualifications and professional titles, tackling the challenge of "uneven application distribution";
- (3) The "internalization" phase emphasizes regular teaching application and practical reflection, compelling

teachers to internalize the acquired explicit knowledge as their own “practical knowledge” in real teaching scenarios. This truly achieves the leap from “possessing technology” to “effectively utilizing technology,” resolving the core pain point of “the disconnect between theory and practice.”

This “practice-reflection-internalization” cycle is key to the upward spiral of knowledge, promoting the formation of teachers’ comprehensive application of “big capabilities.” The limitations of this study are that the samples were obtained from a single center without a control group, and a multi-center randomized controlled study should be conducted in the future to further verify the universality of the protocol. In addition, the long-term effect needs to be tracked to observe the persistence of improved ability.

5. Conclusion

This study demonstrates that training programs developed under the SECI theory framework can significantly enhance clinical nursing educators’ digital literacy. Through a systematic knowledge transformation process, these programs not only facilitate the cyclical conversion between teachers’ tacit and explicit knowledge while advancing their professional capabilities, but also foster a collaborative learning culture via community-based learning and resource sharing. This approach provides a practical solution to bridge the digital divide among educators with diverse backgrounds and systematically addresses challenges in improving digital teaching competencies for clinical nursing education. It is recommended to widely adopt this model in future nursing faculty training programs to continuously drive high-quality development of digital transformation in clinical nursing education.

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Disclosure statement

The authors declare no conflict of interest.

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