

# Development and Examination of an Educational Program Combining E-Learning and Face-to-Face Training That Nurtures Inflammatory Bowel Disease Nurse Specialists

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## Keywords

Crohn's disease · Education program · Inflammatory bowel disease · Nursing practice · Ulcerative colitis

## Abstract

**Introduction:** The number of patients with inflammatory bowel disease (IBD) in Japan has continued to increase, leading to diverse and complex patient backgrounds. Despite these challenges, the education of IBD nurse specialists has not kept pace with the evolving circumstances. Therefore, our research aimed to develop and validate an educational program for the training of IBD nurse specialists. **Methods:** We designed an educational program targeting nurses involved with IBD care. The program included e-learning on the assessment of IBD activity and self-care support, as well as face-to-face group discussions. The understanding and practice of disease activity assessment and self-care support were evaluated before and after the e-learning sessions and face-to-face training. Face-to-face training satisfaction was assessed using the Course Interest Survey (CIS) scale and summarized through descriptive statistics. **Results:** Overall, data from 19 participants were analyzed. Scores

for understanding and practice of disease activity assessment and self-care support increased across all training processes. Moreover, the items that significantly increased before and after e-learning were “inflammation” ( $p = 0.012$ ), “IBD recognition” ( $p = 0.026$ ), and “treatment” ( $p = 0.013$ ) in terms of understanding and “inflammation” ( $p = 0.036$ ) in terms of practice. The items that increased significantly from e-learning to face-to-face training were “inflammation” ( $p = 0.042$ ), “subject symptoms” ( $p = 0.018$ ), and “treatment” ( $p = 0.017$ ) in terms of understanding. No significant differences in mean scores for understanding and practice were observed between the two groups. According to the CIS scale, the “attention” and “relevance” factors indicate that the training design was highly interesting and relevant. However, the “confidence” factor received a slightly lower average score than did the other factors. **Conclusion:** The educational program showed promising implications for the development of IBD nurse specialists. However, further consideration is needed to devise training content that fosters confidence in clinical practice.

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## Introduction

Inflammatory bowel disease (IBD) is a chronic inflammatory disorder of the gastrointestinal tract characterized by cycles of remission and relapse. Generally, this condition encompasses two incurable diseases: ulcerative colitis and Crohn's disease. Although traditionally prevalent in advanced countries, such as those in Scandinavia and the Western world, IBD has shown an increasing trend in developing nations over the recent years [1]. Consistent with global trends, the incidence of IBD throughout Japan has also been increasing [2]. Demand for nurses trained in multidisciplinary care for IBD has been increasing owing to the complexities associated with IBD treatment.

The IBD treatment landscape is rapidly evolving, with recent efforts focusing on achieving endoscopic remission (i.e., mucosal healing) [3]. IBD typically manifests during early adulthood (10s–20s), and symptoms such as abdominal pain, diarrhea, and bloody stools affect the patient physically and psychosocially [4]. Addressing factors that decrease quality of life, such as symptom-related activity restrictions, requires improving the patients' self-care abilities considering that IBD necessitates lifelong management based on one's lifestyle, including work and life events [5]. Additionally, considering that even asymptomatic patients may show mucosal inflammation upon endoscopic examination and that various definitions of relapse have been utilized, potential challenges may emerge in nursing assistance tailored to the disease activity of each IBD patient [6, 7]. Therefore, nursing support should focus on not only self-care but also disease activity assessment tailored to individual patients based on the characteristics of IBD [8].

However, no established educational program is currently available for training nurses specializing in these skills. Given the demand for nurses experienced in IBD care [9], educational programs for training IBD nurse specialists are urgently needed and would likely gain further importance in the future. European countries have developed and implemented education programs for nurses, utilizing e-learning among other methods [10]. In countries where IBD nurses are active, as patients can contact nurses directly, such as by providing nursing assistance over the phone [11], different nursing expertise may be required in Japan. Hence, adopting overseas strategies into domestic education programs may have limitations due to differences in nursing expertise. In Japan, clinical nursing seminars for IBD have been organized by the Japan Inflammatory Bowel Disease Association; however, the training dates and locations for such seminars are limited. Therefore, the current situa-

tion necessitates the development of educational programs for the training of IBD nurse specialists in Japan.

Considering the recent advancements in information and communication technology, e-learning has become a widely implemented training method in nursing education, providing effective training without constraints on time and location. However, studies have shown limitations in the educational effectiveness of standalone e-learning, indicating that a blend of e-learning and face-to-face training is more effective [12]. Moreover, instructional design (ID) based on the attention, relevance, confidence, and satisfaction (ARCS) model has been found to be valuable in clinical nursing education, aligning with the goal of achieving theoretical understanding and practical application [13, 14]. Therefore, we believe that developing an educational program that combines e-learning and face-to-face training based on the ID and ARCS model would be effective for training nurses involved in clinical IBD care.

Considering this, the IBD Nursing Project, an organization comprising nursing researchers [15], has been working toward developing an educational program for training IBD specialist nurses. Starting with an ID-based educational design, our ultimate educational goal is for learners to possess the capabilities of an IBD nurse specialist. Our developed educational program consists of e-learning (1), during which foundational knowledge is acquired, and e-learning (2) with face-to-face training, during which specialization is acquired. We had previously reported on the development and validation of e-learning (1) for acquiring foundational knowledge on IBD nursing [16]. Hence, the current study focused on the next stage and the results of the development and validation of an educational program combining e-learning (2) and face-to-face training.

## Methods

### *Research Design*

The current study developed an educational program for nurses providing care to patients with IBD by employing a pre-post-comparative research design without a control group. Our educational program utilized ID, a systematic approach aimed at enhancing the effectiveness, efficiency, and attractiveness of educational practices [17]. The design of the program focused on creating "IBD nurse specialists with a focus on assessing disease activity assessment and providing self-care support." The entry point for the program, e-learning (1), had been previously reported by Mizuno et al. [16].

Following the principles of ID, the educational project was based on the ARCS model, targeting learner motivation in the domains of attention, relevance, confidence, and satisfaction [18]. The training content, which addressed questions commonly faced by nurses interacting with patients, was designed to stimulate learner interest and relevance, promoting attention and relevance. The training was structured to facilitate step-by-step learning from the basics to application, ensuring that learners cleared each task to foster a sense of accomplishment and confidence. Additionally, the program was designed to provide satisfaction by demonstrating the practicability of the learned content in everyday nursing scenarios.

The e-learning component was available from the early July release date until the day before the face-to-face training scheduled for August 21, 2022. The face-to-face training session was conducted in August in a rented meeting room in Osaka for the participants who completed the e-learning. Participation in both e-learning and face-to-face training was optional, regardless of consent to research participation.

#### *E-Learning*

Our e-learning program utilized Modular Object-Oriented Dynamic Learning Environment (Moodle: version 4.0.1) owing to its cost-effectiveness, ease of customization, and security. To overcome potential difficulties in online system navigation, instructional documents were created in advance and distributed to the participants as data.

Considering the two essential perspectives for nursing assistance to patients with IBD, namely, disease activity assessment and self-care support, e-learning materials, including video training, were developed based on previous studies [5, 8]. To stimulate the ARCS model factors, e-learning was divided into “Introduction to Theory” and “Practical Value” segments for disease activity assessment and self-care support. These segments were incorporated into Moodle as on-demand videos, allowing the participants to learn at their convenience. The content of the training was designed to promote understanding of the theory by explaining each factor of disease activity assessment and self-care support, and to enable the participants to understand how to apply the theory in actual practice. Each video lasted approximately 15 min.

#### *Face-To-Face Training*

The face-to-face training session, which lasted approximately 5 h, involved reviewing theoretical understanding and practical application covered in e-learning.

This included lectures, group discussions based on cases devised by experienced IBD nurses in an IBD-specialized facility, and sharing of opinions among the participants.

#### *Measures*

Basic attributes, such as gender, work location, age, years of nursing experience, and years of IBD nursing experience, were collected through a consent form during the application process.

#### *Participants*

Nurses involved in supporting patients with IBD at facilities treating these patients across Japan were targeted. Invitations were sent to facilities that had physicians registered as IBD specialists on the website of the Crohn’s and Colitis Foundation of Japan [19]. The selection criteria included nurses currently providing care to patients with IBD, with no specific requirements regarding years of experience in IBD nursing, total nursing experience, or employment status.

#### *Self-Evaluation Survey of Disease Activity Assessment and Self-Care Support*

While developing IBD nurse specialists in Japan, we recognized that nurses needed to assess disease activity in patients with IBD and provide self-care support to patients. The evaluation of disease activity is derived from the perspective of nurses experienced in IBD [5], whereas self-care support is viewed from the perspective of supporting self-care abilities derived from investigating patients with IBD [8]. Therefore, we conducted a self-evaluation regarding the understanding and practical application of the five domains of disease activity assessment, namely, “inflammation,” “subjective symptoms,” “(patient’s) awareness of IBD,” “quality of life,” and “treatment” [5], and the five factors related to patient self-care abilities, including “ability to build a human support system,” “ability to acquire knowledge,” “ability to maintain self-manage,” “ability to self-manage,” and “ability to self-assess” [8]. Responses were measured on a 6-point Likert scale, where “completely understood” indicating excellent condition was assigned a score of 6 points and “completely not understood” indicating very poor condition was assigned a score of 1 point. Regarding practical application, “very likely to be applicable” was assigned a score of 6 points, whereas “very unlikely to be applicable” was assigned a score of 1 point. The survey was conducted at three time points: before e-learning (2), after e-learning (2), and after completing the face-to-face training.

### *Evaluation Survey for Face-To-Face Training*

The Japanese version of the Course Interest Survey (CIS) scale was employed to gauge the participants' responses to the training. The CIS had been designed to be consistent with the theoretical framework of the ARCS model, which was utilized in the design of our educational program [20]. The Japanese version of the CIS scale consists of 14 items across four factors of the ARCS model. After examining the validity of the factor structure, the model was found to fit well [21]. The wording was adjusted to suit the content of our educational program. The participants were asked to respond on a 5-point scale ranging from "not applicable at all" (1 point) to "very applicable" (5 points), with higher scores indicating greater awareness of each factor. Questions 4 and 9 serve as reversed items.

### *Overall Satisfaction Survey for the Training*

Satisfaction with the training was assessed based on previous studies [22], covering aspects such as e-learning operation and appearance, online conduct, and overall satisfaction with e-learning training. Additionally, the survey included questions about the difficulty, learning volume, and satisfaction of face-to-face training. The participants responded on a 6-point scale from "very good" (6 points) to "very poor" (1 point).

### *Statistical Analysis*

Descriptive statistics were used to analyze the participants' characteristics. Changes in self-evaluation scores for understanding and practice in disease activity assessment and self-care support before and after e-learning (2) and face-to-face training were analyzed using descriptive statistics as well as Wilcoxon rank-sum test. Furthermore, understanding and practice scores for each training were calculated and analyzed for differences using the Wilcoxon rank-sum test. Descriptive statistics were used to analyze the CIS scale and satisfaction surveys for e-learning and face-to-face training given that these were conducted once after completing the entire educational program. JMP<sup>®</sup> Pro 17.0.0 was used for statistical analysis, with  $p$  of  $<0.05$  indicating statistical significance.

## **Results**

### *Participants*

Recruitment from 264 domestic facilities yielded a total of 75 applicants for research participation. Among them, 63 participants completed e-learning (1), and 49 progressed to e-learning (2). Among the latter, 49, 41, and

19 responded to the survey on disease activity assessment and self-care support before e-learning (2), after e-learning (2), and after completing the face-to-face training, respectively. The total number of participants from e-learning to face-to-face training was 30, among whom 20 responded to the training evaluation and satisfaction survey using the CIS scale. A flowchart for overall study participation is presented in Figure 1.

Table 1 summarizes the basic characteristics of the 19 participants who completed the training. Among the participants, 17 were women (89.5%), with an average age of 39.5 years. Regarding work location, 8 (42.1%) worked in wards and 11 (57.9%) in outpatient departments. Moreover, average nursing experience was  $14.5 \pm 8.0$  years, whereas average IBD nursing experience was  $5.4 \pm 3.9$  years.

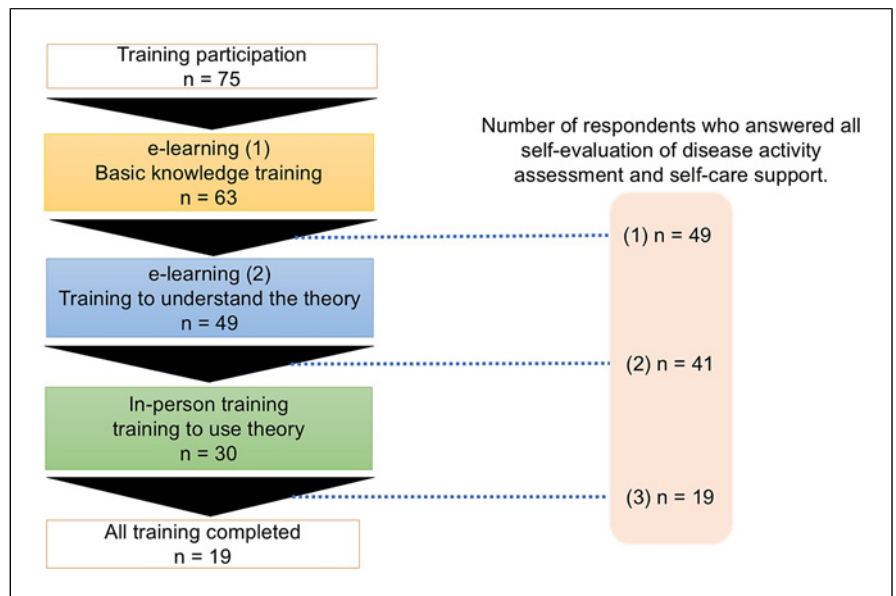
### *Self-Evaluation of Nurses in Disease Activity Assessment and Self-Care Support*

Mean scores increased after following all training approaches in self-evaluation of disease activity assessment and self-care support. The items that significantly increased before and after e-learning were "inflammation" ( $p = 0.012$ ), "IBD recognition" ( $p = 0.026$ ), and "treatment" ( $p = 0.013$ ) in terms of understanding and "inflammation" ( $p = 0.036$ ) in terms of practice. Moreover, items that increased significantly from e-learning to face-to-face training were "inflammation" ( $p = 0.042$ ), "subject symptoms" ( $p = 0.018$ ), and "treatment" ( $p = 0.017$ ) in terms of understanding. The initial understanding score of  $3.99 \pm 0.59$  increased to  $4.25 \pm 0.37$  after e-learning (2) and further to  $4.62 \pm 0.62$ . Similarly, initial practical application score of  $3.94 \pm 0.55$  increased to  $4.23 \pm 0.49$  after e-learning (2) and to  $4.58 \pm 0.72$  subsequently. A comparison between understanding and practice scores in the self-evaluation of disease activity assessment and self-care support exhibited an upward trend in each score throughout the training. Furthermore, a comparison between the mean scores for understanding and practice showed no significant differences. The trends in scores are presented in Figure 2.

### *CIS Scale and Satisfaction Survey for the Training*

The face-to-face training for e-learning (2) participants, conducted amid concerns about the seventh wave of COVID-19 in Japan, saw frequent abstentions from participation due to facility restrictions and personal health concerns. The final number of participants amounted to 30, among whom 20 responded to the training evaluation and satisfaction survey using the CIS scale.

The average score for the attention factor of the CIS scale survey on teaching methods was  $3.86 \pm 0.85$ , indicating that the participants considered it somewhat



**Fig. 1.** Overall educational program and number of participants in each training level.

**Table 1.** Demographic information of the study participants ( $n = 19$ )

Sex, $n$ (%)		
Female	17	(89.5)
Male	2	(10.5)
Workplace, $n$ (%)		
Hospital ward	8	(42.1)
Outpatient	11	(57.9)
Mean age, years	39.5±12.3	
Mean years of experience as a nurse	14.5±8.0	
Mean years of nursing experience with IBD	5.4±3.9	

IBD, inflammatory bowel disease.

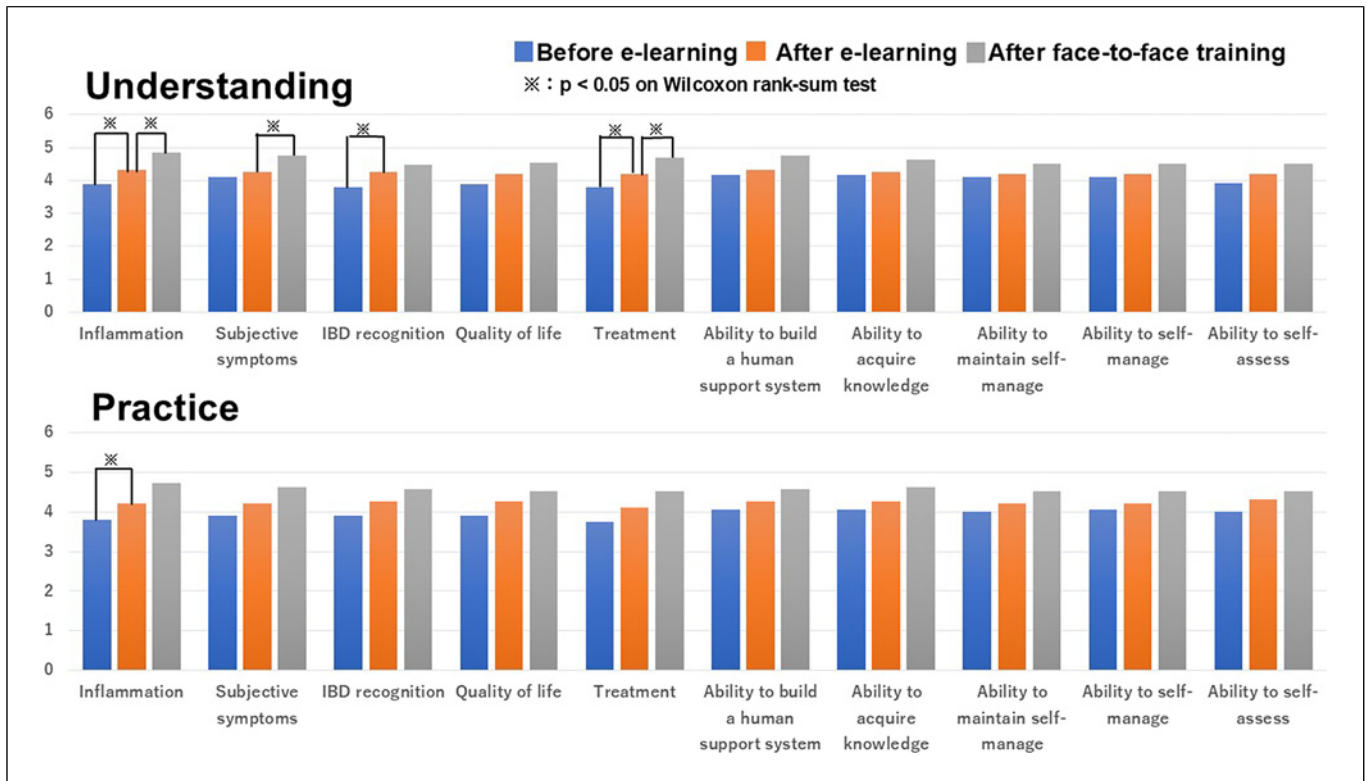
appropriate. The average score for the relevance factor was  $4.10 \pm 0.69$ , with the item “Participants actively participated in this training” scoring particularly high at  $4.45 \pm 0.51$ , showing a high evaluation of the relevance of the training. However, the overall average score for the confidence factor was  $3.42 \pm 0.79$ , with the item “I had confidence in doing this training well” scoring somewhat lower at  $3.05 \pm 0.83$  than the other items. Regarding satisfaction, the overall average score was  $4.03 \pm 0.49$ , indicating that the participants rated their satisfaction with the face-to-face training quite highly. Table 2 presents the details for such scores.

In the satisfaction survey, items related to e-learning (2) [(1)–(5)] all had average scores exceeding 4.50 points, indicating that the participants considered them appropriate. Regarding the evaluation of face-to-face training, the item “Difficulty of face-to-face training” had the

lowest average score at  $4.45 \pm 0.89$  but was still considered somewhat appropriate. The results of the training satisfaction survey indicated that the participants evaluated both as somewhat appropriate to appropriate based on quantity, difficulty, and satisfaction. Table 3 presents the details regarding the satisfaction survey results.

## Discussion

Our findings revealed that e-learning and face-to-face training promoted an overall improvement in the participants’ understanding and practice of self-evaluation of disease activity assessment and self-care support. However, the number of items in which the mean scores increased significantly was limited, and issues that need to be addressed to improve the effectiveness of the



**Fig. 2.** Changes in self-evaluation scores for disease activity assessment and self-care support ( $n = 19$ ). Average scores for each training program are depicted using the graphs.

educational program were identified. Our previous study showed that the educational program demonstrated suggestive indications for fundamental knowledge acquisition from the pretraining test to e-learning (1) [16]. Meanwhile, the current study found that combination of e-learning (2) and face-to-face training provided insights toward the program's ultimate goal of training specialized IBD nurse professionals.

The training had been designed to facilitate discussions geared toward integrating clinical cases and theory, considering practical application. Recognizing the presence of time constraints, our training, which aimed at knowledge acquisition, was conducted efficiently through pretraining online learning instead of face-to-face learning on the day of the session [23]. Therefore, our results revealed a high level of satisfaction in the quantity and quality of e-learning and face-to-face training, respectively. One study reported that increased relevance to daily work is a factor for enhancing training effectiveness [24]. The relevance of the training to daily tasks, as highlighted by the CIS scale, particularly in the "relevance" aspect, was rated highest, indicating that the training was perceived to be closely related to the par-

ticipants' own practices. Therefore, the design of the training, where the participants could feel the relevance of their learning to their everyday nursing practice, influenced their satisfaction with the face-to-face training as measured by the CIS scale.

Although the mean self-evaluation scores for all items related to disease activity assessment and self-care support increased with each session, a limited number of items exhibited significant differences from e-learning to face-to-face training. Specifically, no significant difference was observed in the level of practice from e-learning to face-to-face training. Additionally, mean score for understanding was higher than that for practice, but the difference was not significant. Considering that the items related to disease activity assessment and self-care support were extracted from the perspectives of nurses skilled in IBD nursing and patients with IBD, items related to understanding may have contributed to the increase in scores. However, reason for the stagnant growth in the level of practice may be related to nurses' confidence in their practice. This relationship was reflected in the CIS scale scores, wherein the average score for the confidence factor ( $3.42 \pm 0.79$ ) was slightly lower than that for others,

**Table 2.** Evaluation of teaching methods based on the CIS scale ( $n = 20$ )

Factor of ARCS	Item	Mean±standard deviation
Attention	The instructor livened up the conversation toward key points	4.05±0.69
	The instructor knew how to engage us in this training	3.85±0.81
	The instructor was knowledgeable about various interesting teaching methods	3.95±0.83
	There was little to capture attention in this training (*)	3.60±1.05
	Overall attention average	3.86±0.85
Relevance	In this training, I set high goals and tried to achieve them	3.95±0.76
	It is important to achieve results in this training to accomplish my major objective	4.05±0.60
	The content of this training aligned with my expectations and goals	3.95±0.76
	Participants actively participated in this training	4.45±0.51
	Overall relevance average	4.10±0.69
Confidence	The content of this training was too challenging for me (*)	3.50±0.61
	The difficulty level of this training was appropriate, not too easy, or too difficult	3.70±0.80
	I had confidence in doing this training well	3.05±0.83
	Overall confidence average	3.42±0.79
Satisfaction	I was satisfied with the instructor's evaluation compared to what I had anticipated for the tasks	3.80±0.62
	I believe my training outcomes and other evaluations were fair, similar to other participants	4.20±0.41
	The amount of tasks I had to do in this training was appropriate	4.10±0.31
	Overall satisfaction average	4.03±0.49

\*Reverse items.

**Table 3.** Satisfaction survey results ( $n = 20$ )

No.	Question	Mean±standard deviation
1	Simplicity of e-learning system operation	4.50±1.05
2	Appearance of the e-learning screen	4.55±0.83
3	Amount of e-learning training	4.70±0.80
4	Difficulty of e-learning training	4.70±0.80
5	Satisfaction of e-learning	4.65±0.88
6	Amount of face-to-face training	4.70±0.92
7	Difficulty of face-to-face training	4.45±0.89
8	Satisfaction of face-to-face training	4.65±0.99
9	Taking knowledge training courses online (e-learning)	4.85±0.75

with the item “I had confidence in doing this training well” having an average score of  $3.05 \pm 0.83$ . Conversely, the training itself was not extremely difficult, considering that both difficulty levels were rated as somewhat adequate in the satisfaction surveys for e-learning (2) and face-to-face training. However, participants may have experienced difficulty in translating their theoretical understanding of disease activity assessment and self-care

support into practical confidence. According to the Dunning-Kruger curve, learning does not necessarily trigger a linear increase in confidence with understanding; instead, fluctuations in confidence levels may occur as knowledge increases, with a subsequent rise in confidence once a certain level of knowledge is acquired [25]. Although training did increase the participants' understanding, it may have also temporarily hindered their

confidence in their own abilities, causing their level of practice to stagnate comparatively. Therefore, although the training content encouraged theoretical understanding, there was a need to further consider content that would instill confidence for practical application in clinical settings.

A comparison between our IBD nursing education program and those overseas revealed educational content similarities, following a step-by-step process from basic to advanced, varying to certain degrees [26, 27]. One difference is that our program incorporates nursing theories on disease activity assessment [8] and self-care support [5], which we believe will help nurses autonomously plan the necessary care for patients with IBD. However, a difference in our program is that it lacks pediatric and transitional content, which should be incorporated.

One limitation of the current study was the lack of a control group, which necessitates caution when interpreting the effectiveness of the education program. Future evaluation of our education program with control groups is essential. Additionally, this study conducted surveys at three time points, and the participants took the online training at their own timing. Considering the potential variations in the participants' understanding and practical application scores due to the learning period, the survey timing needed to be standardized. However, conducting the training online might have contributed to the satisfaction with the education program.

The education program designed by combining e-learning and face-to-face training provided suggestive indications for training IBD nurse specialists. Discussions involving clinical cases, recalling episodes with patients, and enhancing the relevance of the content increased the learning effectiveness of this training approach. Although the training content did promote theoretical understanding, further development is warranted to foster confidence in clinical practice.

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## Statement of Ethics

This study protocol was reviewed and approved by Kansai Medical University and the Ethical Review Committee of the institution, Approval No. 2022103. We were conducted following ethical principles stated in the Declaration of Helsinki. In the study's description, informed consent was obtained through written explanations on the website. Written informed consent to participate was not directly obtained but inferred by completion of the questionnaire/participation in the interview. These details highlighted the voluntary nature of participation, option for refusal or withdrawal, possibility of attending training without study participation, and assurance that nonparticipation would carry no disadvantages. To ensure anonymity and diligent data management, the collected data were anonymized to prevent individual identification.

## Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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## Author Contributions

Hikaru Mizuno, Yu Fujimoto, and Natsuko Seto initiated the entire research process from conception to data collection. Yoshiko Furukawa, Koji Yamamoto, Mayu Katashima, Kayoko Sakagami, and Maya Nunotani contributed to the creation of e-learning, educational programs, and training sessions, and to the data collection process.

## Data Availability Statement

The data that support the findings of this study are not publicly available due to, e.g., perspectives on protecting rights of the participants, but are available from the corresponding author (H.M.) upon reasonable request.



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