Research Article

Development and Validation of an E-Learning Educational Program for Acquiring Basic Knowledge in Inflammatory Bowel Disease Nursing

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Abstract

Introduction: This study focuses on developing and validating an e-learning educational program for nurturing inflammatory bowel disease (IBD) nursing specialists. *Methods:* The program was developed using the attention, relevance, confidence, and satisfaction models within the instructional design framework. The program validation encompassed four steps: (1) nurses took a basic IBD knowledge test (pretest), (2) participants scoring <80% were encouraged to undergo web-based training, (3) a follow-up test (posttest) gauged post-training improvement, and (4) participant satisfaction with e-learning was assessed. *Results:* The analysis included 63 participants. The average score in the pretest was 81.3%, 40 participants exceeded the pretest passing score, which is 80% (average: 88.3%), and 23 participants failed (average: 69.1%). Of those who failed, 19 participants showed improvement after undergoing web-based training, with their posttest scores exceeding the passing threshold (average: 97.4%). The comparison results between the passing and failing groups revealed no correlation between the baseline characteristics of the participants. The participants were highly satisfied with the e-learning program. *Conclusion:* The program was effective as an educational program for acquiring basic knowledge to foster IBD nursing professionals. The learning design was adapted to the participants' lifestyles and tailored to the readiness of the nurse, ensuring a satisfactory e-learning user experience for the nurses.

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Introduction

Inflammatory bowel disease (IBD), encompassing chronic inflammatory conditions of the intestinal tract characterized by repeated remissions and relapses, comprises two primary disorders: ulcerative colitis and Crohn's disease [1]. In Japan, the patient count for ulcerative colitis and Crohn's disease was expected to exceed 220,000 and 70,000, respectively, in 2014, with a continuous rise in patient numbers observed since the 1990s [2]. Treatment options encompass a combination of medical and surgical therapy, diet and nutritional therapy, and various other treatments [3].

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Recently, the focus of IBD treatment has shifted toward achieving endoscopic remission [4]. Consequently, even among patients experiencing clinical remission, endoscopic examinations may unveil mucosal inflammation. This underscores the need for nurses to provide comprehensive support to patients with IBD by evaluating disease activity through individualized patient care, which includes inflammation assessment using objective measures [5].

IBD is often characterized by symptoms including abdominal pain, diarrhea, and bloody stool and persists chronically with repeated flare-ups and remissions. This trajectory can lead to long-term restrictions on daily activities while triggering concern about psychosocial effects extending beyond the disease's physical dimension [6]. Studies have highlighted the substantial demand for nurses to facilitate self-care, which contributes to individuals' self-actualization across employment, lifestyle, and life events [7, 8]. Harnessing the self-care abilities of patients with IBD can result in improved QOL [9].

Because patients with IBD must select one treatment option that suits their lifestyle and maintain a treatment – work balance while achieving developmental goals, nurses must proficiently assess disease activity and provide suitable self-care guidance. In the practice of nursing care, nurses must possess the fundamental knowledge encompassing pathophysiology, diagnosis, examination, and treatment while demonstrating the ability to holistically assess patients' living conditions and needs. Owing to the evolving epidemiological landscape, the need to train IBD specialist nurses is both urgent and poised to gain heightened importance in the future.

Although IBD treatment options and changing treatment goals have diversified, there is no program in Japan to train IBD nursing specialists. IBD nursing care guidelines play a role in multidisciplinary management [10], particularly in providing clinical support and treatment education [11]. Previous reports have shown that IBD nursing practices can improve patient outcomes [12–15]. Based on the IBD nursing care index [16], IBD nurses are required to improve their competence from a clinical perspective. Therefore, patient interventions by IBD nurses are an individual practice that can improve patient outcomes in multidisciplinary management, and a certain level of quality assurance is necessary. However, practices adopted by foreign nurses, such as nurse-led telephone calls and medication reconciliation, are challenging to apply in Japan. Thus, there is a difference between Japanese and foreign nursing practices. This divergence curtails the seamless adaptation of foreign findings into domestic educational initiatives. Although educational seminars for clinical nurses have been held in Japan, the availability of these seminars to the general public is limited due to constraints related to dates and locations, highlighting the need for developing educational programs to foster IBD nursing professionals in this country.

Recently, the demand for online training using information communication technology has surged due to COVID-19-triggered activity restrictions. Utilizing information communication technology-based training will likely be effective in preparing nurses to provide professional assistance to patients with IBD, thereby improving their outcomes. The attention, relevance, confidence, and satisfaction (ARCS) model within the instructional design (ID) framework is useful in designing training programs for clinical nurse education [17]. Training design based on the ID and ARCS models are suitable for continuing nursing education [18]. Therefore, an educational program that follows the ARCS model within the ID framework, offering training sessions to nurses involved in clinical IBD nursing, can effectively foster IBD nursing professionals. Therefore, an e-learning training program for acquiring basic knowledge in IBD nursing was developed and validated as part of a project to foster IBD nursing professionals. This study aimed to validate the efficacy of an e-learning (1) educational program for acquiring basic knowledge on IBD nursing practice.

Materials and Methods

Study Design

This study adopted a prospective quantitative survey approach through a self-administered, anonymous online questionnaire. This educational program incorporates ID, a methodology concerning a systematic approach to enhancing the effectiveness, efficiency, and attractiveness of education [19]. ID clarifies the "current status of learners," which is the entry point, and sets the "learning objectives," which is the exit point, so that training can be designed to meet learner needs. Therefore, considering the various growth stages nurses undergo, from new to mid-level and skilled nurses [20], the entry point was "having basic knowledge of IBD as the required qualities for new IBD nurses." The exit point was "to develop IBD nursing professionals who focus on assessing IBD activity from a nursing practice perspective and support self-care." Therefore, e-learning (1) was used as an educational program to acquire basic knowledge of IBD as an entry point to the program. The program was designed to assess participants' readiness for further professional development, and in cases where deficiencies existed, the participants underwent web-based training. The exit point was designed so that the goal could be achieved through e-learning (2) and in-person training. Figure 1 presents the educational program framework.

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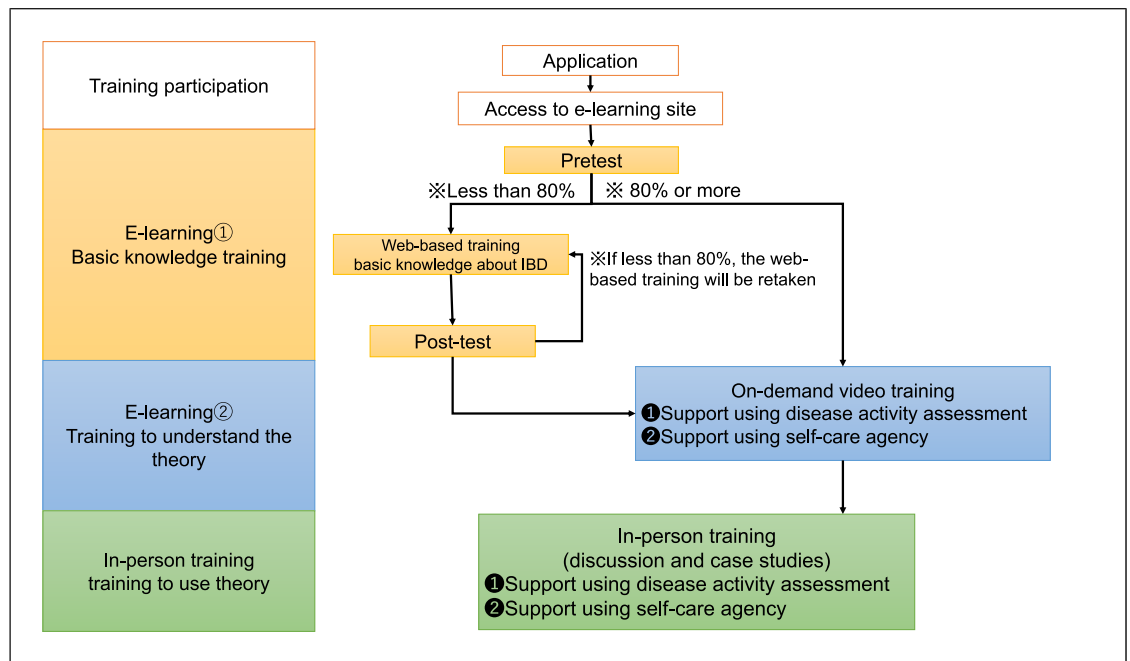
Fig. 1. Framework for IBD nursing professional development educational programs.

This training design employed the ARCS model. This model creates strategies to stimulate and maintain learners' motivation in four areas: ARCS [21]. The proposed program focuses on the subject matter pertinent to nurses engaged in clinical care for patients with IBD, addressing potential queries. Our approach aims to facilitate incremental learning for the participants, progressing from foundational concepts to practical applications. This method empowers the subject to accomplish each task systematically, building confidence along the way. Additionally, the program was structured to make the training content directly applicable to everyday nursing scenarios. This approach aims to enable participants to establish a link between their clinical practice and the acquired knowledge, ultimately leading to a sense of satisfaction.

Development of Teaching Materials
During e-learning (1) development, we reviewed previous research and discussions with IBD specialists, IBD nurse practitioners, and IBD nurse researchers, and found the following topics to be relevant to the clinical practice of nurses: "Structure and Function of the Digestive Organs," "Characteristics of IBD, UC, and CD," "Examination of IBD," "Treatment of IBD," and "Diet and Nutrition Therapy." To confirm the acquisition of basic knowledge, a test reflecting the contents of these five chapters and web-based materials was created. The test comprised four option-based questions for single best answer selection, with a question pool consisting of 40 questions. Participants who scored below the standard were required to undergo web-based training and retest to ensure that all learners had acquired basic knowledge before proceeding to the next stage, e-learning (2). We defined these tests and web materials as e-learning (1).

E-Learning System
Modular object-oriented dynamic learning environment (Moodle: Version 4.0.1), a learning management system, was used for e-learning owing to its cost-effectiveness, ease of customization, and security. In this Moodle, we embedded our established tests and web materials to ensure that learners can receive e-learning (1). E-learning (1) is designed to incorporate only knowledge so that learners can take the test at any time and complete the course using a computer or cell phone. The pretest comprises 20 random questions per chapter from a question pool of 40. A score ≥80% is required to complete e-learning (1); learners who score ≥80% can still learn through web-based materials. Learners scoring <80% must learn through the web-based materials and undergo a confirmation test. For course completion, a score ≥80% is required in all chapters. To address challenges related to the online system and potential confusion in its operation, an instruction manual was prepared in advance and distributed to the participants. Furthermore, the learners could ask questions at any time via e-mail about Moodle operation and training content.

The e-learning courses (1) and (2) were open to the public from early July until the day before the in-person training on August 21, 2022. These e-learning courses were open to all participants regardless of their consent to participate in the study.

Participants
Nurses involved in supporting patients with IBD at facilities treating these patients in Japan were invited to participate. Participants were recruited from facilities where physicians registered as IBD specialists were listed on the website of the Crohn's and Colitis Foundation of Japan [22]. According to these lists [22], 186 facilities in Japan provide IBD treatment. Assuming that there are

3–4 nurses at these facilities providing care to patients with IBD, there are 550–650 nurses in Japan. Based on these numbers, we targeted ~60 people or 10% of the target population. The selection criteria for the subjects were nurses currently providing nursing care to patients with IBD. Years of experience in IBD nursing, years of nursing experience, work status, and employment status were not considered.

Measures
Participant Background
Upon applying for training through the website, participants were required to provide their consent for participation in the research. Those who agreed to the study were asked to enter their demographics (sex, workplace, age, years of nursing experience, and years of IBD nursing experience) and were able to take a pretest at any time.

Percentage of Correct Answers in the Test
The percentage of correct answers (0–100%) in the pretest was automatically collected by Moodle, and those who passed the pretest with a score ≥80% were asked to complete an e-learning satisfaction survey. Participants who did not achieve a score of 80% in the pretest were randomly assigned questions from the same question pool used for the pretest for each of the following chapters – "Structure and Function of the Digestive Organs," "Characteristics of IBD, UC, and CD," "Examination of IBD," "Treatment of IBD," and "Diet and Nutrition Therapy" – in Chapters 1 through 5 of the web-based training.

Scoring Change Ratio
We defined "first post test score" as the first test score percentage after receiving training through web-based materials as the primary measure of the effectiveness of web-based materials and the posttest. Furthermore, we collected the scores of the second and subsequent tests training through web-based materials as the "last post test score" because the score may be <80% after the retest.

E-Learning Satisfaction
The survey items on satisfaction with e-learning were developed following previous studies [23]. The survey items were related to the operation and appearance of e-learning, the content and difficulty of the test, the online session, and e-learning. For those who took the web-based training with <80% in the pretest, we added the items "Training amount," "Training difficulty," and "Taking the test again after attending the training" to the above items. All items were rated on a six-point scale ranging from very good (6 points) to very bad (1 point).

Statistical Analysis
The baseline characteristics were summarized by descriptive statistics, and the scores of the passing and failing groups were compared: the former comprised those who scored at least 80% on the pretest, and the latter comprised those who scored below 80%. The φ coefficients for the two groups and "workplace" were obtained from Pearson's χ^2 test, while association between the two groups with "years of nursing experience" and "years of IBD nursing experience" explored by nominal logistic regression analysis. The failing group was readministered the posttest after undergoing web-based training, and the test was terminated upon

Table 1. Demographic information of the study participants (N = 63)

Sex, *n* (%)		
Female	60	(95.2)
Male	3	(04.8)
Workplace, *n* (%)		
Hospital ward	27	(42.9)
Outpatient clinic	34	(54.0)
Others	2	(3.2)
Mean age, years (SD)	39.5	±10.6
Mean years of experience as a nurse (SD)	16.5	±09.3
Mean years of IBD nursing experience (SD)	6.2	±05.8

IBD, inflammatory bowel disease; SD, standard deviation.

achieving at least an 80% score. Descriptive statistics were used to check changes at three points in time: pretest, first posttest, and final posttest score rates. Statistical analysis software JMP®PRO 17.0.0 was used, and the significance level was set at $p < 0.05$.

Results

After mailing invitations for research requests to 264 facilities, 75 applied for training participation and 68 agreed to participate in the study (agreement rate: 90.7%). Of the 68 respondents, 3 respondents who did not enter their demographic information and 2 respondents who reported zero years of IBD nursing experience were excluded from the study population, leaving a total of 63 respondents for the analysis. Table 1 shows the baseline characteristics.

Furthermore, 40 participants passed the pretest as they achieved at least an 80% score, while 23 failed as they scored below 80% (63.5% exceed rate). The overall mean score was 81.3%, with the passing group having an average of 88.3% and the failing group having an average of 69.1%. Of the 34 participants working in the outpatient clinic, 25 and 9 were in the passing and failing groups, respectively. Of the 27 participants working in the wards, 14 and 13 were in the passing and failing groups, respectively. The φ coefficient from Pearson's χ^2 test was 0.224 ($p = 0.079$), indicating no significant association. Nominal logistic regression of the association between the two groups and years of nursing experience revealed an odds ratio of 1.017 and a 95% confidence interval of 0.963–1.077 ($p = 0.531$), and an odds ratio of 1.076 and confidence interval of 0.974–1.224 for years of IBD nursing experience ($p = 0.157$). A significant association was not observed between the pretest and baseline characteristics. Table 2 shows the details.

Table 2. Comparison of the baseline characteristics of the passing and failing groups (N = 63)

Variable	Passing group		Failing group		Total		p value
Total score (SD)	88.3	±6.4	69.1	±5.4	81.3	±11.0	<0.001
Years of experience as a nurse (SD)	17.1	±9.3	15.6	±9.8	16.5	±9.4	0.531
Years of IBD nursing experience (SD)	6.9	±6.7	4.9	±3.8	6.2	±5.9	0.157
Workplace, n							
Hospital ward	14		13		27		0.079
Outpatient clinic	25		9		34		

The Wilcoxon rank-sum test was used for mean scores, nominal logistic regression analysis was used for years of experience as a nurse as well as IBD nursing experience, and the Pearson χ^2 test and φ coefficient were used for workplace. IBD, inflammatory bowel disease; SD, standard deviation.

Table 3. Scoring change ratio

Item	Mean score percentage±standard deviation	
Percentage of pretest scores	69.1	±05.4
Score rate for the first posttest after receiving web training	86.8	±11.7
Score rate for the final posttest after receiving web training	97.4	±03.8

Of the 23 participants in the failing group, 19 underwent web-based training from Chapters 1 to 5 and completed all posttests, while 4 dropped out of the course. The average score of the failing group was 69.1% at the time of the pretest but improved to 86.8% after one attempt at the posttest, and 14 of the 19 participants had an average score above 80% after taking the first test. Six participants passed the posttest for all chapters in one attempt, and 13 participants passed the posttest for each chapter after multiple attempts. This test was designed such that a minimum score of 80% must be obtained for each chapter to meet the requirements of passing the test. Thus, participants who scored below 80% for some chapters were noted, despite achieving an overall score of ≥80% in the first posttest. Thus, when the 19 participants scored above 80% on all chapter tests, their scoring rate improved further, with an average score of 97.4% at the time of the final score. Table 3 shows the details.

Table 4 shows the percentage of correct responses for each question and chapter in the pretest. The number of respondents for each question varied due to the randomness of the questions. Chapter 3 had a relatively high mean, whereas Chapters 4 and 5 had relatively low percentages of correct answers.

Notably, 13 respondents did not respond to the e-learning satisfaction survey and dropped out, including 9 who passed the pretest but did not respond to the satisfaction survey, and 4 who did not respond to the post test. Thus, 50 respondents finally responded to the satisfaction survey on e-learning.

The satisfaction survey results are shown, with participants categorized by those who passed or failed the pretest. The average satisfaction scores of the group passing the pretest were higher than those of the group failing the pretest. Furthermore, the average scores of Q1 "Operation simplicity" and Q2 "Appearance of the screen" indicated that the participants found the training system easy to use and read. Furthermore, the mean scores for each of Q3 "Test taken at the start of the training," Q6 "To be developed while looking at the correct answers and explanations of the test," Q7 "Testing amount," and Q8 "Testing difficulty" indicated that the participants were somewhat satisfied with the pretest. The questions for the failing group, Q4 "Training amount," Q5 "Training difficulty," and Q9 "Taking the test again after attending the training" indicate that the participants were somewhat satisfied with the amount and difficulty of the web-based material and retest. The average scores for Q10 "Taking the course online," and Q11 "Overall training" indicated that the participants were extremely satisfied with the training. Table 5 shows further details.

Discussion

The educational program developed in this study was effective, as ~60% of the participants passed the pretest, with those who failed the pretest improving their score

Table 4. Percentage of correct answers in pretest

Chapter	Question	Percentage of correct answers (%)	n
Chapter 1 Structure and Function of the Digestive Organs	1-a Which is the correct organ/tissue located in the small intestine?	97.0	34
	1-b Which is true for the organs and tissues located in the large intestine?	90.2	41
	1-c Which is true about the structure of the digestive tract?	68.8	32
	1-d Which is true about the function of the digestive tract?	55.8	43
	Average response rate for Chapter 1	78.0	
Chapter 2 Characteristics of IBD, UC, and CD	2-a Which is incorrect about IBD?	89.5	38
	2-b Which is incorrect about IBD?	88.2	34
	2-c Which is true about IBD?	97.4	39
	2-d Which is true about IBD?	97.4	39
	2-e Which is correct about the characteristics of Crohn's disease?	91.9	37
	2-f Which is correct about the intestinal complications of Crohn's disease?	87.1	31
	2-g Which is correct about endoscopic findings of Crohn's disease?	81.1	37
	2-h Which is correct about the characteristics of ulcerative colitis?	73.3	45
	2-i Which is correct about the intestinal complications of ulcerative colitis?	54.1	37
	2-j Which is correct about the endoscopic findings of ulcerative colitis?	39.5	38
	Average response rate for Chapter 2	80.0	
Chapter 3 Examination of IBD	3-a Which test is necessary for the diagnosis of Crohn's disease?	97.6	41
	3-b Which test is incorrect for the diagnosis of Crohn's disease?	97.1	34
	3-c Which test is necessary for the diagnosis of ulcerative colitis?	96.4	28
	3-d Which is an incorrect test for the diagnosis of ulcerative colitis?	95.7	47
	3-e Which is the correct laboratory test to evaluate the inflammatory status of Crohn's disease?	91.7	36
	3-f Which test is incorrect for monitoring the disease status of Crohn's disease?	85.7	35
	3-g Which is the correct laboratory test to evaluate the inflammatory status of ulcerative colitis?	86.1	43
	3-h Which test is incorrect for monitoring the disease status of ulcerative colitis?	88.9	35
	Average response rate for Chapter 3	92.4	
Chapter 4 Treatment of IBD	4-a Which is correct regarding medical therapy for Crohn's disease?	90.9	33
	4-b Which is incorrect regarding medical therapy for Crohn's disease?	91.5	47
	4-c Which is correct regarding drugs used in the pharmacological treatment of Crohn's disease?	75.0	36
	4-d Which is correct regarding medical therapy for ulcerative colitis?	80.6	36
	4-e Which is incorrect regarding medical therapy for ulcerative colitis?	46.9	32
	4-f Which drug is correct for use in the pharmacological treatment of ulcerative colitis?	76.9	39

Table 4 (continued)

Chapter	Question	Percentage of correct answers (%)	n
	4-g Which is correct regarding the surgical treatment of Crohn's disease?	78.1	41
	4-h Which is correct regarding postoperative complications of Crohn's disease?	62.2	37
	4-i Which is correct regarding surgical treatment of ulcerative colitis?	63.6	33
	4-j Which is correct regarding postoperative complications of ulcerative colitis?	74.4	38
	Average response rate for Chapter 4	74.0	
Chapter 5 Diet and Nutrition Therapy	5-a Which is correct regarding nutritional therapy for Crohn's disease?	91.7	36
	5-b Which is incorrect about nutritional therapy for Crohn's disease?	87.2	39
	5-c Which is correct about nutritional therapy for ulcerative colitis?	16.7	36
	5-d Which is incorrect regarding nutritional therapy for ulcerative colitis?	51.3	39
	5-e Which is incorrect regarding the application of nutritional therapy for Crohn's disease?	91.9	37
	5-f Which is correct about enteral nutritional therapy for Crohn's disease?	85.7	42
	5-g Which is correct about transvenous nutritional therapy for Crohn's disease?	66.7	36
	5-h Which is correct about dietary and nutritional therapy for Crohn's disease?	100.0	35
	Average response rate for Chapter 5	73.9	

The question is in the form of a right/wrong question in which one of four options should be selected. For reasons of space limitation, the choices are omitted. The questions were randomly set up so that there would be 20 questions in total, with random questions from each chapter. This will ensure that there is variation in the number of respondents to each question. IBD, inflammatory bowel disease; CD, Crohn's disease; UC, ulcerative colitis.

Table 5. E-learning satisfaction survey

No.	Question	Passing group			Failing group		
		mean±SD	max–min	n	mean±SD	max–min	n
1	Operation simplicity	4.69±1.03	6–3	32	4.33±0.84	6–3	18
2	Appearance of the screen	4.88±0.94	6–3	32	3.89±0.76	5–2	18
3	Test taken at the start of the training	4.81±0.83	6–3	31	4.41±0.80	6–3	17
4	Training amount[a]				4.39±0.92	6–2	17
5	Training difficulty[a]				4.29±0.99	6–2	16
6	To be developed while looking at the correct answers and explanations of the test	5.19±0.78	6–3	32	4.50±1.10	6–2	17
7	Testing amount	4.90±0.89	6–3	32	4.11±1.13	6–2	17
8	Testing difficulty	4.75±0.92	6–3	32	4.28±0.89	6–3	17
9	Taking the test again after attending the training[a]				4.59±0.87	6–4	16
10	Taking the course online	5.59±0.61	6–4	32	4.78±0.94	6–4	17
11	Overall training	5.16±0.86	6–4	31	4.70±0.92	6–3	16

[a]Nos. 4, 5, and 9 are conducted only for those who failed the pretest. SD, standard deviation.

rate upon undergoing web-based training. Furthermore, the elevated satisfaction levels indicated by the e-learning survey suggest that nurses are likely to acquire a proficient user experience. Based on the ID concept, this educational program has established training objectives with clear entry and exit points, which were derived from the needs of nurses involved in IBD nursing. Therefore, the pretest and the web-based course materials effectively prepared the participants for entry into the course to prepare them to become IBD nursing professionals. Additionally, based on the ARCS model, the difficulty levels of the pretest and the structure of the web materials were created based on participant readiness, and Moodle was employed to ensure a user-friendly and engaging volume and structure aimed at preventing participant disinterest.

It was difficult to assess whether workplace, years of nursing experience, and years of IBD nursing experience were related to pretest scores because there were no significant differences between pretest pass/fail and nurses' baseline characteristics. The S-shaped curve is known as a typical type of learning curve in the knowledge acquisition of nurses in their specialized fields. This means that a constant growth rate is observed at the beginning of skill acquisition, but after some time, the growth rate stagnates and then increases again [24]. As no significant difference was observed in the number of years of experience between the passing and failing groups, some participants were in a stagnant period regarding knowledge acquisition. As professional autonomy is necessary to overcome this stagnation [24], autonomous learning content and learning experience, rather than years of experience, are predicted as a factor for classifying knowledge acquisition status. Therefore, when evaluating nurse readiness for IBD nursing, assessing the learning content of the individual is more important than attributes that change over time, such as years of experience.

Based on the pretest, we inferred the areas where the participants were strong and weak. According to the percentage of correct answers for each chapter, the accuracy rate was relatively high for "Examination of IBD" but relatively low for "Treatment of IBD" and "Diet and Nutrition Therapy." These trends suggest that knowledge about procedures, such as testing, is relatively easy to obtain, but knowledge about treatment and diet is often lacking, depending on the facility's characteristics and the nurses' background. Therefore, further study on treatment and diet/nutritional therapy may increase the relevance of

these issues to nurses' clinical practice and enhance the effectiveness of their education.

The test score for the failed group increased from 69.1% (pretest) to 86.8% (first posttest). This suggests that undergoing web-based training and then taking the posttest contributed to knowledge acquisition. The average score rate on the final post test was 97.4%, but as the score rate naturally improved when the participants repeated the test until they finally completed all chapters, determining whether the increased final score rate truly contributed to knowledge acquisition in training seemed difficult. As training to acquire basic knowledge in IBD nursing, the process of undergoing web-based training and then taking a posttest once is expected for acquiring enough knowledge without having to repeat the test until completion.

Online seminars in an on-demand format were in high demand. Although the participants were unlikely to have much experience with e-learning, they rated themselves as somewhat satisfied with the "operation simplicity" and "appearance of the screen" in the satisfaction survey. Despite the participants' unfamiliarity with online training, the provision of comprehensive explanatory materials facilitated the successful execution of a highly satisfactory online training program. Therefore, the participants' high satisfaction with the online course format and their overall contentment with the course suggest a great demand for an online seminar centered on IBD nursing. To enhance the efficacy of e-learning, the utilization of educational materials with varying levels of complexity [25] has been advocated. This approach enables participants to engage in self-directed learning at their own convenience [26, 27]. Therefore, the free time of the course, which suits the participants' lifestyles, and the pretest to prepare the participants' readiness were factors that increased satisfaction levels.

Despite the findings, this study has some limitations. The relatively small number of participants may pose challenges in comparing identifying factors related to passing/failing in the baseline/posttest. This educational program is the first IBD nursing professional development project in Japan and is expected to contribute to improving the ability of nurses involved in IBD nursing. Therefore, our findings are significant for nurses who work with patients with IBD, regardless of whether patients are inpatients or outpatients. Although previous studies have described the assurance of quality of care by meeting the recommended number of IBD nurses in an organization [28], further empirical validation within

this educational program is warranted, considering the current situation where even small numbers of nurses can significantly impact patient outcomes.

Conclusion

In this study, ~60% of the participants passed the pretest, and for those who failed, the score improved after undergoing web-based training. As a training program aimed at acquiring basic knowledge in IBD nursing, the process of taking the test after taking the web-based training was effective for those who did not meet the requirements initially. This online educational program allows participants to take a preliminary test to determine the need for training. Its high satisfaction levels contribute to an assured positive user experience for nurses.

Acknowledgments

We would like to thank all the nurses who participated in the training and responded to the questionnaire, and all the IBD specialists who helped us prepare the training materials.

Statement of Ethics

This study protocol was reviewed and approved by the Medical Ethics Review Committee of the institution to which the researcher belongings (Approval No. 2022103) and was conducted following the Declaration of Helsinki. Written informed consent to participate was not directly obtained but inferred by completion of the questionnaire/participation in the interview. Informed consent was obtained through written explanations on the website. 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.

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 the data collection process.

Data Availability Statement

The data supporting the findings of this study are not publicly available due to (e.g., privacy reasons) but are available from the corresponding author (H.M.) upon reasonable request.

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