Araştırma makalesi

Hemşirelikte Beceri Gelişiminde E-Öğrenme Sistemlerinin Kullanımına İlişkin Bir Ölçüm Aracının Geliştirilmesi ve Öğrenci Görüşlerinin Belirlenmesi

Developing an Assessment Instrument on theUsage of E-Learning Systems in Skill Development in Nursing and Determining Student Views

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Özet:

Amaç: Bu çalışma, e-öğrenmede Hemşirelik Beceri Gelişimi Değerlendirm eAracı (e-HBGDA) geliştirmek ve hemşirelik öğrencilerine göre e-öğrenmenin beceri gelişimine katkısını değerlendirmek amacıyla tasarlanmıştır.

Yöntem: Metodolojik ve tanımlayıcı türdeki olan bu çalışmanın örneklemini Türkiye'deki 469 hemşirelik öğrencisi oluşturmuştur. Veriler anket formu ve e-HBGDA kullanılarak toplanmıştır.

Bulgular: Faktör analizi sonuçlarına göre e-HBGDA'nın bir faktörden oluştuğu ve bu faktörün toplam varyansın %70'ini açıkladığı belirlenmiştir. Ölçeğin cronbach alfa değeri 0.96'dır. Öğrencilerin e-HBGDA'dan aldıkları ortalama puan 42.16±13.50'dir. Öğrencilerin e-öğrenmeyi beceri geliştirme üzerinde orta düzeyde etkili buldukları belirlenmiştir.

Sonuç: e-HBGDA, öğrencilerin e-öğrenmede beceri geliştirme düzeylerini ölçmek için geçerli ve güvenilirdir.

AnahtarKelimeler:e-Öğrenme; hemşirelik; beceri geliştirme; değerlendirme; ölçek geliştirme.

Abstract:

Aim: In any learning experience, it is very important to understand not only one's strengths and weaknesses, their increase in knowledge and attitude, but also how the learning experience contributes to the improvement of the intended skill. This study was designed to develop the Nursing Skill Development Assessment Instrument in e-learning (e-NSDAI) and investigate the contribution of e-learning to skill development according to nursing students.

Methods: This study was methodological and descriptive. The study was conducted with 469 nursing students in Turkey. Data were collected using an Introductory Information Form and e-NSDAI.

Results: According to the factor analysis results, factor one of E-NSDAI explained 70% of the total variance. The Cronbach's alpha value of the scale was found as 0.96. The mean E-NSDAI score of the participants was determined as 42.16±13.50.

Conclusion: The e-NSDAI is a valid and reliable instrument to measure students' levels of skill development in e-learning. The participants found e-learning to be moderately effective on skill development.

KeyWords:e-Learning; nursing; skill development; evaluation; scale development.

INTRODUCTION

In nursing education, it is aimed to provide students with cognitive, affective and psychomotor knowledge and skills and transform these gains into behavior. In line with this purpose, students are provided with psychomotor skills by means of theoretical expression, clinical applications and role-play in the conventional education method. In time, laboratory practices and simulation applications have also been included. [1-3] Although new methods have been tried as a complement to face-to-face education, no practice was able to fully replace face-to-face education, and these have been evaluated as complementary practices. [1,4]

The rapid spread of the coronavirus disease - 2019 (COVID-19) affected the education system all over the world and led to radical organizational changes in conventional teaching methods. [5] The most important of these changes is the implementation of the e-learning system, which was expected prevent the interruption of learning. [6] E-Learning systems are web-based software developed to teach, monitor and manage courses over the internet. [7] These systems are systems equipped with features that enable communication between instructors and students, allow sharing course content, and offer opportunity to implement surveys, exams and chat functions. [8]

On March 12, 2020, when the impact of the pandemic was seriously felt in Turkey, the Council of Higher Education (CoHE) decided that universities should suspend education. As of March 23, 2020, universities switched to the distance education system. Courses were given in the e-learning system, and clinical practices were suspended. [9] The e-learning system entered our lives as a necessity, not as an alternative, with the COVID-19 pandemic. However, it is difficult to switch to the e-learning system in departments where learning and teaching are mostly practice-based, such as nursing. [10] Therefore, it is extremely important to evaluate the usage of e-learning systems separately in departments like nursing departments where applied and psychomotor skill development is important.

There are studies evaluating the general e-learning system during the pandemic period. However, in these studies, although the advantages and disadvantages of e-learning have been questioned, no evaluation has been made in terms of the contribution of e-learning to gaining nursing-specific skills [11,12]. In any learning experience, it is very important to understand not only one's strengths and weaknesses, their increase in knowledge and attitude, but also how the learning experience contributes to the improvement of the intended skill. [13] In the literature review in this study, no measurement instrument that evaluated the effects of e-learning on skill development was found. Considering this situation, we realized that there is a

need for a measurement instrument that reveals the effects of knowledge gained through e-learning on skill development by comparing face-to-face and e-learning methods through students' self-assessments.

The aim of this study was to develop a measurement instrument that evaluates the contribution of e-learning to nursing skill development and investigate the contribution of e-learning to skill development according to nursing students.

METHODS

Study Design and Sampling

The sample of this methodological and descriptive study consisted of 2nd-, 3rd- and 4th-year students studying at the nursing departments of universities during the COVID-19 pandemic. The criteria for inclusion in the were having received face-to-face education in the nursing department before the pandemic, not studying at schools that provided face-to-face education during the pandemic, studying at the nursing department of any university in Turkey at the time of the research, and being 2nd-, 3rd- or 4th-year students. In Turkey, due to the pandemic measures initiated in March 2020, face-to-face education was suspended at universities, and some university students were excluded from the study in the 2020-2021 academic year, considering that they could not make a comparison because they had not received face-to-face education in their 1st year in nursing education. Within the scope of the study, data were collected from 498 students studying at 8 universities covering all geographical regions of Turkey. Twenty-nine students were excluded from the study due to being in their 1st year of study or incomplete data. The research flowchart is shown in Figure 1.
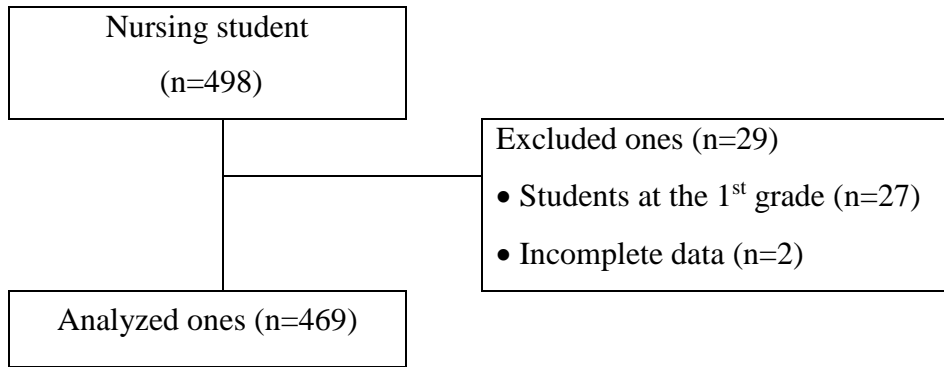
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┌─────────────────────────┐
│   Nursing student       │
│     (n=498)             │
└─────────────────────────┘
          │
          │         ┌──────────────────────────────────────┐
          │         │  Excluded ones (n=29)                │
          │         │  • Students at the 1st grade (n=27)  │
          │         │  • Incomplete data (n=2)             │
          │         └──────────────────────────────────────┘
          │
┌─────────────────────────┐
│  Analyzed ones (n=469)  │
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Figure 1. Research flowchart

Procedures for Scale Development

The Nursing Skill Development Assessment Instrument in e-learning (e-NSDAI) was developed to investigate the contribution of e-learning given to nursing students during their undergraduate education to their skill development. A pool of 22 items was created by the researchers in line with the literature and their own teaching experiences. [12,14,15]

Content validity

After the item pool was created, the Q methodology was first used for the review and revision of the items. It has been reported that the Q methodology can be applied to samples sizes between 25 and 75 people, and due to the nature of this method, the number of respondents can be either as much as the number of items/statements or at most twice the number of items/statements [16,17]. For this reason, 22 undergraduate nursing students were asked to rate these 22 items on a scale ranging from a = item is appropriate to d = item is not appropriate. Afterwards, focus group interviews were conducted with 8 nursing instructors, and it was aimed to assess and rank the most appropriate and significant items. For content validity testing, 5 experts with a background in teaching and learning were invited to conduct an expert panel review. Opinions were received from these five experts to evaluate the intelligibility of the items of the instrument and their suitability in terms of language. The evaluation of the collected expert opinions was made using the Davis method. In line with the

expert opinions regarding content validity, the items with a score below 0.80 were removed, and the number of items in the instrument was reduced from 22 to 15. For a final evaluation, the draft instrument was administered to 30 nursing students as a pilot implementation, and the instrument was given its final form.

Test-retest reliability measurement was used to measure the time-invariance of the scale over time. Two weeks after the first application of the 15-item final version of the scale, data were collected from 50 students in total. The Pearson product-moment correlation coefficient was used to examine the correlations between the data collected in the 1st and 2nd implementations of the final version of e-NSDAI. The mean reliability coefficient was 0.91, with a range from 0.81 to 0.91.

Data Collection Instruments

A questionnaire consisting of three parts was used to collect data. An Introductory Information Form formed the first part, questions about the participants' access to technology while using the e-learning system were included in the second part, and e-NSDAI constituted the third part. The items in e-NSDAI were created to question how the e-learning system contributes to the development of nursing skills in comparison to conventional face-to-face teaching. The participants evaluated each item on a 5-point Likert-type scoring system with response options ranging from "very good (5)" to "very bad (1)". The minimum and maximum scores that can be obtained from the scale were 15 and 75. A high score was accepted as an indicator of the positive contribution of e-learning to the development of nursing skills. The Cronbach's alpha value of the scale was calculated as 0.95.

Data Collection

The questionnaire form was transferred to the Google Forms platform, and a link was created to share the questionnaire. The created link was shared by the researchers on social media platforms (e.g., Facebook, Instagram), and potential participants were invited to the study.

A pilot study was conducted with 30 nursing students to test the comprehensibility of the questionnaires before data collection began. The second implementation was made to analyze test-retest reliability with 50 participants, by sending them the form via e-mail, 2 weeks after the first implementation of the final form of the scale, and their participation was requested.

Ethical Aspects

Necessary permissions were obtained for the collection of research data Tokat Gaziosmanpasa University Ethics Committee approval (09.04.2021/08/01-02). Additionally, to inform the individuals to be included in the study, explanations on the topic of research, the purpose of the study and the time expected to be spent to fill the questionnaire were added to the first page of the questionnaire form. Moreover, consent to participate was obtained by adding a section before the participants could start to answer the questionnaire: "I agree to participate in the study in question voluntarily and without any pressure or coercion: ( ) Yes, ( ) No". The participants who did not answer as "yes" to this question could not continue to fill out the questionnaire.

Data Analysis

IBM SPSS Statistics 25.0 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp., USA) was used for the statistical analyses. The analyses of the collected data included descriptive statistics as frequencies, percentages, means and standard deviations. Student's t-test and one-way analysis of variance (ANOVA) were used to analyze the differences between groups. Cronbach's alpha and item-total score

correlation coefficients were used to determine the internal consistency of the measurement instrument, and Kaiser-Meyer-Olkin (KMO) test, Bartlett test of sphericity and Exploratory Factor Analysis (EFA) tests were used to determine construct validity. The results were evaluated in a 95% confidence interval, and the level of statistical significance was accepted as $p < 0.05$.

Results

1. Validity and Reliability of e-NSDAI

Reliability

As a result of the analyses about the reliability of the scale, the item-total score correlation coefficients of the items were above 0.20, and there was no item with a negative correlation value. So, no item was removed. The Cronbach's alpha correlation coefficient was used to determine the internal consistency of the scale as a measure of reliability. As a result of the calculation, the Cronbach's alpha internal consistency coefficient for the entire scale was found to be 0.96 (Table 1).

Data were collected again from a total of 50 students 2 weeks after the first implementation of the scale. The Pearson product-moment correlation coefficient was used to examine the correlation between the data collected in the two implementations. No significant difference was found between the total mean scores of the participants in e-NSDAI at two different time points ($p < 0.05$). This result indicated that the scale had time-invariance. [18]

Table1. e-NSDAI Item Total Correlation and Internal Consistency Analysis

Items	Corrected item total correlation	Cronbach's alpha if item deleted
Item 1	.616	.957
Item 2	.614	.957
Item 3	.768	.953
Item 4	.768	.953
Item 5	.812	.953
Item 6	.780	.953
Item 7	.776	.953
Item 8	.706	.955
Item 9	.840	.952
Item 10	.754	.954
Item 11	.811	.953
Item 12	.795	.953
Item 13	.763	.954
Item 14	.745	.954
Item 15	.784	.953
Total Cronbach alpha	.957	

Construct Validity

In order to reveal the factor structure of the scale, exploratory factor analysis was performed. As a result of the Kaiser-Meyer Olkinand Bartlett's tests performed to examine the suitability of the data and sample size for factor analysis, it was seen that the KMO coefficient was 0.95, and the Bartlett's test statistic was significant ($p<0.001$). The fact that the KMO coefficient was above 0.60, and the Bartlett's test statistic was significant ($p<0.001$) showed that the dataset was suitable for factor analysis, and the sample size was sufficient. [19,20]

The relationship between an item and a factor is explained by the factor load value, and it is stated that the items in each factor should have a factor load of at least 0.30. [21,22] The factor load values of the items in e-NSDAI varied between 0.65 and 0.87 (Table 2).

Table 2. e-NSDAI Exploratory Factor Analysis Results

ItemNumber	FactorLoads
Item 1	.652
Item 2	.649
Item 3	.800
Item 4	.799
Item 5	.845
Item 6	.816
Item 7	.812
Item 8	.750
Item 9	.869
Item 10	.794
Item 11	.844
Item 12	.830
Item 13	.795
Item 14	.779
Item 15	.815
Percentage of variance explained (%)	70.03

2. Evaluation of Nursing Skill Development of Students with e-Learning and Determining Their Opinions

The mean score of the participants from the scale developed to evaluate the effectiveness of the e-learning system in their skill development was determined as 42.16±13.50. Considering the minimum and maximum scores of the scale, the participants assessed the effectiveness of the e-learning system as above average (Table 3).

The results of the comparisons of the attitudes of the participants towards the use of the e-learning system in skill development and their introductory information are shown in Table3 According to these results, the participants who had a personal computer they used to attend the classes had a significantly higher mean total scale score (44.49±15.54) than those who took the class with a tablet, phone or shared computer (p<0.05). It was determined that those who had a private room to attend the classes had a significantly higher mean total score (43.73±13.51) compared to those who did not, those who used simulation in the classes had a significantly higher mean total score (52.01±13.52) compared to those who did not, those who were satisfied with the e-learning system had a significantly higher mean total score

(48.69±12.49) compared to those who were not, and those who recommended the continuation of the e-learning system had a significantly higher mean total score (49.03±12.42) than those who did not (p<0.05).

Table 3. Comparison of e-NSDAI Total Mean Scores of the Students According to Their Various Characteristics (n=469)

Variables	n (%)	Mean ± SD	Test value
Sex			
Female	372 (79.3)	41.78±13.48	t=-1.193
Male	97 (20.7)	43.61±13.56	p=.233
Year of Study			
2nd Year	215 (45.8)	40.79±13.24	F=2.517
3rd Year	132 (28.1)	42.54±13.17	p=.082
4th Year	122 (26.0)	44.16±14.13	
Name of University			
TokatGaziosmanpasa University	242 (51,6)	44.43±13.34	
Nineteen May University	22 (4,7)	41.68±15.56	
HititUniversity	29 (6,2)	36.79±12.92	
Gaziantep University	59 (12,6)	39.42±11.96	F=2.453
Sanko University	45 (9,6)	40.11±15.18	**p=.013**
Harran University	22 (4.7)	41.75±10.70	
SinopUniversity	24 (5.1)	35.14±10.45	
Bingol University	26 (5.5)	42.84±14.69	
Internet infrastructure			
Yes	394 (84.0)	42.66±13.57	t=1.862
No	75 (16.0)	39.50±12.88	p=.063
Source of Internet			
Wi-Fi (Wireless Fidelity)	310 (66.1)	42.72±13.33	t=1.270
Mobile Data	159 (33.9)	41.05±13.80	p=.205
Gadgets for attending online classes			
Own personal computer/laptop	108 (23.0)	44.49±15.54	
Mobile	284 (60.6)	42.21±12.51	F=3.133
Tablet	6 (1.3)	44.00±9.87	**p=.025**
Computer	71 (15.1)	38.25±13.61	

Dedicated room for attending online classes

Yes	293 (62.5)	43.73±13.51	t=3.285
No	176 (37.5)	39.54±13.12	**p=.001**

Simulation use

Yes	55 (11.7)	52.01±13.52	t=5.969
No	414 (88.3)	40.85±12.96	**p<.001**

Are you satisfied with e-learning?

Yes	159 (33.9)	48.69±12.49	t=7.994
No	310 (66.1)	38.80±12.77	**p<.001**

Do you want the e-learning system to continue?

Yes	123 (26.2)	49.03±12.42	t=6.886
No	346 (73.8)	39.71±13.04	**p<.001**
e-NSDAI		**42.16±13.50**	

It was determined that the mean total scale score of the male students was higher (43.61±13.56) than the mean total score of the female students, the mean total score of those who were in their last year was higher (44.16±14.13) than those who were in other years of study, the mean total score of those who had a strong internet infrastructure was higher (42.66±13.57) compared to those who did not have such infrastructure, and the mean total score of those who used home internet to attend the classes (42.72±13.33) was higher than those who used mobile internet, but these differences were not statistically significant (p>0.05).

The effects of different characteristics of the students on skill development in the e-learning system are presented in Table 4. Accordingly, all 9 predictor variables and multiple regression model were statistically significant (F = 12.267. p<0.001), and 19% of the variance in the effects of e-learning on nursing skill development according to the nursing students was explained by the independent variables (R^2 = 0.194; adjusted R^2= 0.178). Moreover, it was determined that the usage of simulation in classes and being satisfied with the e-learning system were significant factors affecting the participants' views on the effect of e-learning on

their skill development. A one-point increase in the usage of simulation in classes corresponded to 8.99-point increase in the scale score (p=0.000, 95% CI=5.42-12.56), and a one-point increase in satisfaction with e-learning corresponded to an increase 6.43-point increase in the scale score (p=0.000, 95% CI= 2.95-9.90). It was determined that other variables had a positive effect on the scale scores of the participants, but this effect was statistically insignificant (p>0.05) (Table 4).

Table 4. The Effect of Different Characteristicson Skill Development in e-Learning

Descriptive variables	B	SE	Beta	p	95% CI Lower	95% CI Upper
Constant	34.492	1.617		**.000**	31.314	37.669
1. Male	2.441	1.440	.073	.091	-.389	5.271
2. 4th grade	1.940	1.356	.063	.153	-.725	4.604
3. Having Internet infrastructure	1.293	1.855	.035	.486	-2.352	4.937
4. Using home internet	.302	1.473	.011	.837	-2.592	3.197
5. Using personal computer	.051	1.435	.002	.972	-2.770	2.872
6. Having a private room while attending classes	1.934	1.256	.069	.124	-.533	4.402
7. Using simulation	8.994	1.817	.214	**.000**	5.424	12.565
8. Satisfaction with e-learning	6.430	1.769	.226	**.000**	2.953	9.906
9. Suggesting e-learning to continue	3.508	1.892	.114	.064	-.211	7.227

Table 5 shows the views of the participants on the advantages and disadvantages of e-learning and solution recommendations to increase the quality of e-learning. The participants were allowed to mark multiple options as an answer to each of these questions. Among the benefits of e-learning, the participants chose reduction in the risk of transmission the most and unlimited repetition opportunity as the second most frequent answer. As disadvantages, lack of equipment and lack of practice were in the first two places in the participants' responses. Among the solution recommendations of the participants, the first two most frequently stated ones were the usage of different methods together and holding applied courses face-to-face (Table 5).

Table 5. Nursing Students' Advantages and Disadvantages of e-Learning and Solution Suggestions for Improving e-Learning

About e-learning	n (%)
Advantages	
Saving of time	215 (45.8)
Saving of education costs (such as course materials, road, shelter, food)	120 (25.5)
Opportunity of unlimited repetitions	233 (49.6)
Reduction in the risk of transmission	351 (74.8)
Disadvantages	
Lack of equipment(computer, internet, suitable home environment, etc.)	392 (83.5)
Lack of motivation	271 (57.7)
Lack of interaction	161 (34.3)
Lackof application	346 (73.7)
Too much distraction	148 (31.5)
Suggestions	
Having the materials (vials, syringes, probes, sponges, etc.) specific to the subject discussed during the course and showing them to the students	118 (25.1)
Face-to-face application of applied courses, hybrid method of others	324 (69)
Combination of different methods (video, demonstration, case analysis)	387 (82.5)
Giving particular importance to the visuals on the slides	
	246 (52.4)

Discussion

Compared to face-to-face education, e-learning is often seen as attractive for universities and education providers because of its cost-effectiveness in cases of large groups of students. [23,24] Furthermore, it is a beneficial teaching system for students due to its advantages such as flexibility, cost-effectiveness, time management, and course repetition. [10,25] It seems inevitable that e-learning, which has become more prominent in education rapidly with the COVID-19 pandemic, will remain in the education experiences of students after the pandemic. Therefore, it is very important to ensure that the role of technology in nursing education is understood well. [4,23,24] It seems that e-learning will take place more in nursing education from now on. The measurement instrument that was developed in this study is an important resource for evaluating the effect of e-learning education on developing nursing skills. In this study, reliability and factor analyses were performed to test the usability of the measurement instrument. According to the results of the analyses, the Cronbach's alpha coefficient of the instrument was 0.96, and this indicated its high reliability. It was determined

that the instrument consisted of 1 factor with an eigenvalue of 9.40, and this factor explained 70% of the total variance.

The three main areas of learning are cognitive (knowledge, comprehension and critical thinking), psychomotor (skill development) and affective (emotional and behavioral responses) [26]. Performance evaluation in nursing education covers these three main areas [4]. Although it is easier to obtain cognitive gains through e-learning systems, it is a method that fails to help students gain affective and psychomotor skills. [4,11] Evaluation of readiness for practice can be made by evaluating the cognitive, psychomotor and affective domains [4]. In this study, in which the views of nursing students regarding the usage of e-learning systems in skill development were determined, it was observed that the participants found e-learning to be moderately effective on skill development with a mean score of 42.16 ± 13.50. To the best of our knowledge, there are no other studies in the literature evaluating the effects of e-learning on the skill development of nursing students. There are studies evaluating attitudes towards e-learning. In a study evaluating the attitudes of nursing students towards e-learning in Nepal, it was reported that only 34% of students found e-learning as effective as conventional face-to-face learning. [10] Similarly, in the study by Singh et al., only 20% of students reported that they thought e-learning could replace traditional classroom education. [11] We interpreted these results as that e-learning is on a moderate level regarding its effects in skill development as clinical education is indispensable for students. The results in this study may have been due to the fact that nursing students who are accustomed to learning by doing think they cannot learn sufficiently via distance education.

In this study, it was determined that more than half of the participants (66%) were not satisfied with e-learning, and the majority (74%) thought that the e-learning practice should not continue. Similar to our results, the majority of participants in other studies in the literature have stated that they wanted to receive education with the conventional method.

[10,15] Since nursing is a profession that is learned by doing, students are not sure enough whether they can learn it with distance education. The generally medium level of the scale scores of the participants of this study was an indication that they were not confident enough about what and how much they should do.

Statistically significant differences were identified in the mean e-NSDAI scores of the participants of this study based on variables such as the school that they were attending, their status of having a personal computer and a private room to attend the classes, their status of using simulation in the classes, their satisfaction with e-learning, and their status of wanting to continue e-learning. In a study evaluating nursing students' attitudes towards e-learning in Nepal, no statistically significant relationship was found between attitudes towards e-learning and selected sociodemographic variables such as age, place of residence, college, years of education, and previous participation in e-learning. [10] In a study evaluating the experiences of nursing students (undergraduate, postgraduate) transitioning from face-to-face education to e-learning in the first months of the COVID-19 pandemic in Spain, it was reported that e-learning imposed limitations for older students, those living in rural areas, those with work and family responsibilities, and those with limited electronic resources. [27] In another study conducted in Nepal, it was revealed that age, education level, family income and region of residence were factors affecting satisfaction with e-learning. [25] In our study, while age and class were not an effective factor in skill development, e-learning was perceived as more of a limitation for older students in studies evaluating attitudes. The reason for this situation may be that the other authors included employees who had a master's degree in their study, and there were cultural differences due to the fact that the studies were carried out in different geographical regions. Moreover, the common limiting factor in different studies has been the lack of access to technology. [10,25,27]

With its many advantages and disadvantages for both educational institutions and students, e-learning is a savior in terms of ensuring continuity in education during the COVID-19 pandemic period. In this study, the advantages of e-learning were stated by the participants as time management, reduction in the risk of transmission, and unlimited repetition opportunity. Similarly, in the study by Mukhtar et al., most students stated that online learning provides advantages due to easy management and accessibility, and less resource and time usage [28]. Subedi et al. reported that e-learning has advantages such as saving time, spending time with family, reducing costs, and lowering risk of infection. [25] Lack of equipment and internet connection problems were expressed as the most common problems in online teaching. Similar factors were reported as disadvantages in other studies. [10,25,28] Factors causing problems in following classes such as some of the students' lack of home internet and usage of mobile internet, running out of data packages, and lack of internet infrastructure were determined as disadvantages in our study. It is thought that the state, universities and non-governmental organizations should come together and support students in solving problems related to lack of equipment. With the FATIH project, which was previously implemented in secondary education institutions in Turkey, tablet computers were distributed to all students. [29] It is thought that it would be beneficial to start similar projects for university students in all countries of the world in this process.

In this study, the participants recommended that the use of simulations in the classes, having and showing the materials (e.g., vial, syringe, probe, sponge) specific to the topic that is explained during the class, using different methods such as video, demonstration and case analysis, and adopting the hybrid education method would be effective in increasing skill development levels in e-learning. The study carried out by Muktar et al. during the COVID-19 pandemic period showed similar outcomes to the recommendations of the participants of our study. In their study, it was reported that sharing laboratory and clinical skill

demonstration videos with students would be beneficial in the development of psychomotor skills. [28] In the literature, there are studies showing that the use of educational videos, case-based learning, role-play, interviews, exams, small group activities, online simulations, and web-based interactive courses in nursing education increases the quality of students' clinical skills. [15,30-32]

It was thought in this study that it is important to develop a measurement instrument that can be used to evaluate the effects of the e-learning system on skill development to contribute to the literature. With the measurement instrument, students were provided with the opportunity to self-evaluate, and they were encouraged to evaluate themselves clearly. Furthermore, a full evaluation was made by asking questions regarding both their home environment (internet access, home internet, having a personal computer, private room facility) and their education processes (usage of simulation). The fact that first-year students were not included in the study because they had not experienced face-to-face and applied education ensured that the data were homogeneous. Additionally, the inclusion of students from 8 universities in different regions of Turkey in the study was important in terms of generalizing the study to the whole country. The cross-sectional nature of the study was accepted as a limitation.

With the scale developed in this study, the effects of education given through e-learning on the skill development of students can be evaluated. Moreover, since the scale does not focus on a specific area and covers all nursing skills, it can be used to evaluate general skills. Although the scale was developed specifically for the COVID-19 pandemic period, it can also be used to evaluate hybrid teaching methods to be integrated into the curriculum in the post-pandemic period and to compare face-to-face education during and after the pandemic.

Conclusion

It was determined in this study that e-learning is currently a moderately effective teaching method in nursing skill development. It was seen that the school that the participants were attending, their status of having a personal computer and a private room to attend the classes, using simulation in the classes, their satisfaction with e-learning and wanting to continue e-learning were effective factors on their skill development scores. The participants stated that e-learning has advantages such as time management, reduction in the risk of transmission, unlimited repetition opportunities, as well as disadvantages such as lack of equipment and internet problems, which caused problems in their ability to follow the classes. They thought that using simulation in the classes, having the materials explained during the class, and the presentation of the practice applications by the instructor of the course would increase the effect of e-learning on skill development. Based on the findings of this study, to increase the effect of e-learning on skill development, it is thought to be necessary to use simulation in classes, the instructor of the course should explain the practice applications with the necessary materials, parameters such as the use of multiple teaching materials (e.g., video, presentation, demo) together should be considered, the appropriateness of the equipment and environment that students need while attending classes such as the internet and room availability should be ensured, and cooperation should be made with other institutions to provide these opportunities.

Consequently, it is extremely important to evaluate the effectiveness of e-learning systems in skill development in applied sciences such as nursing and use them as supportive methods if students need them.

In future studies, researchers are recommended to conduct studies with large samples that include academicians and evaluate other aspects of e-learning.

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