

The Effect of Basic Life Support Training based on Web-Based Application on Perceived Learning, Knowledge, Satisfaction and Self-Confidence: A Mixed Method Study

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ABSTRACT

Aim: Computer-assisted learning provides students with the opportunity to access and reuse the material at any time and supports self-directed learning. This study aims to evaluate the effect of a web-based application for basic life support training on nursing students' perceived learning, knowledge, satisfaction and self-confidence.

Material and methods: In the initial phase of the study, an application with basic life support was developed. Subsequently, students were divided into intervention and control groups, and the forms and scales used for data collection were administered as pre- and post-tests. In the qualitative phase, focus group discussions were conducted with 12 students who used the application, using a semi-structured interview form. Descriptive analysis was used for quantitative data and thematic analysis was used for qualitative data.

Results: Students using the application showed no significant difference between the knowledge, perceived learning, satisfaction and self- confidence scores, but all the scores of the intervention group were higher. Two themes were identified: (I) Gains from experiences, (II) Criticism and development of the application.

Conclusion: It has been observed that web-based simulation application is a useful method in achieving learning outcomes in the cognitive domain and also positively affects psychomotor applications. In addition, it has been found that the application provides individual gains and positively affects learning experiences.

Keywords: Gamification; nursing students; nursing education; teaching method.

Web Tabanlı Uygulamaya Dayalı Temel Yaşam Desteği Eğitiminin Algılanan Öğrenme, Bilgi, Memnuniyet ve Öz güven Üzerindeki Etkisi: Bir Karma Yöntem Çalışması

ÖZ

Amaç: Bilgisayar destekli öğrenme, öğrencilere materyale istedikleri zaman erişme ve tekrar kullanma olanağı sağlar ve öz-yönelimli öğrenmeyi destekler. Bu çalışma, temel yaşam desteği eğitimi için web tabanlı bir uygulamanın hemşirelik öğrencilerinin algılanan öğrenme, bilgi, memnuniyet ve özgüvenleri üzerindeki etkisini değerlendirmeyi amaçlamaktadır.

Gereç ve Yöntemler: Çalışmanın ilk aşamasında temel yaşam desteğini içeren bir uygulama geliştirilmiştir. Daha sonra, öğrenciler müdahale ve kontrol gruplarına ayrılmış ve veri toplama için kullanılan form ve ölçekler ön ve son test olarak uygulanmıştır. Nitel aşamada ise uygulamayı kullanan 12 öğrenci ile yarı yapılandırılmış görüşme formu kullanılarak odak grup görüşmeleri gerçekleştirilmiştir. Nicel veriler için betimsel analiz, nitel veriler için ise tematik analiz kullanılmıştır.

Bulgular: Uygulamayı kullanan öğrencilerin bilgi, algılanan öğrenme, memnuniyet ve özgüven puanları arasında anlamlı bir fark görülmezken, müdahale grubunun tüm puanları daha yüksek çıkmıştır. İki tema elde edilmiştir: (I) Deneyimlerden elde edilen kazanımlar, (II) Eleştiri ve uygulamanın geliştirilmesi.

Sonuç: Web tabanlı simülasyon uygulamasının bilişsel alanda öğrenme çıktılarına ulaşmada faydalı bir yöntem olduğu ve psikomotor uygulamaları da olumlu yönde etkilediği görülmüştür. Ayrıca uygulamanın bireysel kazanımlar sağladığı ve öğrenme deneyimlerini olumlu yönde etkilediği tespit edilmiştir.

Anahtar Kelimeler: Oyunlaştırma; hemşirelik öğrencileri; hemşirelik eğitimi; öğretim yöntemi.

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INTRODUCTION

Nursing education is a comprehensive process that integrates theoretical and clinical learning and aims to gain knowledge and skills together. Nurse educators guide students to achieve specific learning outcomes aligned with nursing professional standards. Holistic learning that focuses on cognitive, emotional and psychomotor learning areas is achieved through innovative learning methods (1,2). As technology advances, high-fidelity simulations, standardized patients, serious games, scenario-based videos, and concept maps are increasingly used in health education to develop both technical and non-technical skills (1,3,4). Simulation applications in nursing education help students integrate knowledge and skills, learn through practice, refine their performance, and minimize errors in clinical practice by simulating real-life situations that enhance theoretical understanding, skill development, and critical thinking (5,6).

Web based computer learning is one of the methods preferred by institutions in crowded groups, few instructors and a limited clinical area. With the onset of coronavirus disease, teaching skills and knowledge through distance learning has become popular in the field of education. It provides students to access and reuse the material at any time and supports self-directed learning. Moreover, they can be used individually and in groups, create less stress for educators and students, are easy to use, not necessary a professional team, and have lower costs compared to high-fidelity simulators (4,7,8). The use of these materials ensure that students are better prepared for real-world clinical environments and reinforces the transformation of theoretical knowledge into practice. It creates a positive impact on student motivation, teamwork, perception, attitude, anxiety, satisfaction and self-confidence (3,9,10,13). According to literature, simulation-based teaching methods have been used to improve students' basic/advanced life support practices/skills and have showed similar beneficial effects on nursing students as compared to traditional method (11-13).

Furthermore, digital education tools support nursing education and should be added to the curriculum. It has been concluded that digital tools provide various advantages in improving learning outcomes and creating a more engaging and enjoyable environment for students (4,13).

Understanding the effectiveness of educational methods across cognitive, affective, and psychomotor domains remains an ongoing research area in nursing education. Addressing this gap, the authors investigated the impact of a computer-based basic life support (BLS) application on nursing students' skills using a mixed-method approach.

Therefore, we aimed to examine the effect of a web-based simulation application (WBSA) developed for BLS training on nursing students' knowledge, satisfaction, self-confidence, and perceived learning levels by using mixed method.

MATERIAL AND METHODS

Study design and sampling method

The study was conducted with mixed method approach (14). The study population consisted of 200 third-year nursing students. We assumed a Cohen's *d* of 0.5 for the power analysis (15). Assuming a 95% confidence level, an alpha value of 0.05, and a power of 0.7 led to a calculated sample size of 34 participants per group for a *t*-test.

Participants were randomly assigned to intervention and control groups using a simple random number table generated by an online service (<https://www.random.org/lists/>). Assignment to the groups was done by an independent nurse researcher.

In the qualitative stage, the purposive sampling method (*n*=12) was used. The exclusion criteria were as follows: students with BLS experience in clinical practice, those who had participated in first aid courses, or international students. Participants who wanted to leave at any point of the study and failed to complete all stages of the training program (2 students) and failed to fill in the data collection tools (2 students) were excluded from the study (Figure 1).

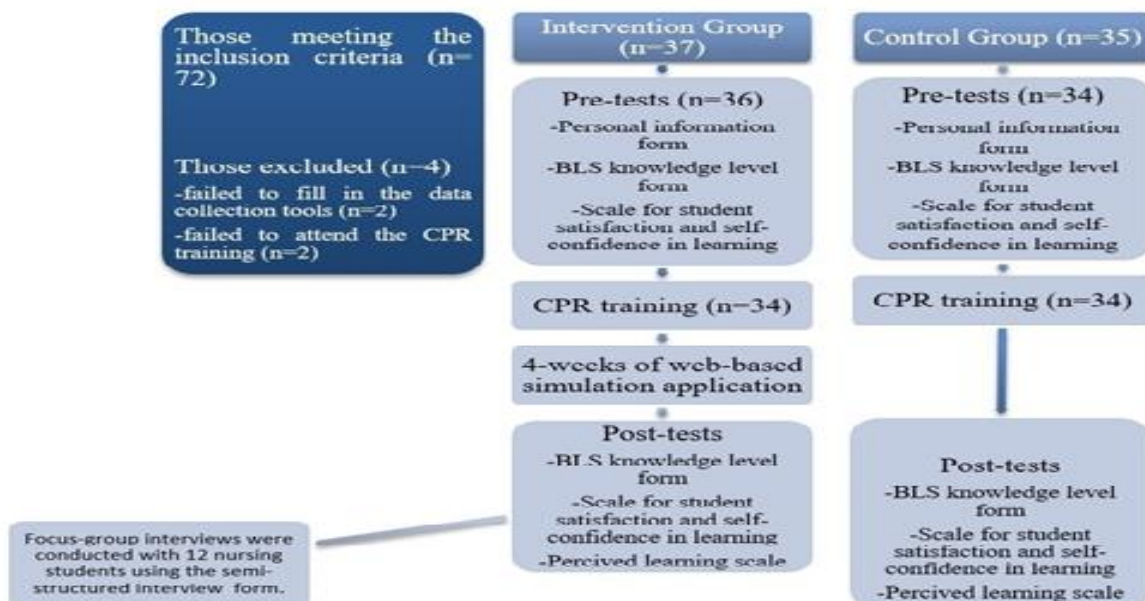


Figure 1. Study flow chart

Web-Based Simulation Application

Researchers developed a web-based program with a simple, user-friendly interface using Unity (Unity Software Inc, Unity Technologies, San Francisco, US, 2022.1.23). It was a game development platform, to teach adult BLS skills. The BLS training content was developed in accordance with the guidelines (16-17). The application simulated a BLS case based on a heart attack scenario in a shopping mall, reflecting the real environment (Figure 2).



Figure 2. Web-based simulation scenario

After logging in with a username and password via a web-based link, students watch a 6-minute, 51-second video explaining the steps of the BLS application and then perform these steps by answering evaluation questions. In the application steps, different modules (steps of modules: checking consciousness, opening the airway, checking circulation, deciding and starting CPR, managing BLS correctly, and terminating CPR) were performed by students using the mouse (Figure 3, Figure 4).



Figure 3. Starting compressions in a patient with cardiac arrest



Figure 4. Use of automated external defibrillators

The web-based simulation application in this study was prepared by utilizing the recent guidelines. Then continue to the features of the application. In this application, relevant instructions and information were presented to students with information boxes, and students were directed to the previous step in case of incorrect applications. Students progressed by completing the expected action correctly. At the end of the application, a report containing the student's performance data was produced to provide students to evaluation the deficiencies or incorrect applications they made during the application in the report. The duration of the application was approximately 15-20 minutes. The content validity and quality of the application were evaluated by four experts, and a pilot study was carried out with 10 students and necessary adjustments were made.

Data collection forms

Personal Information Form: It consisted of socio-demographic questions such as the participants' age, gender, and the type of school/high school they graduated from.

BLS Knowledge Level Form: It was prepared by the researchers according to literature. It consisted of 20 questions about BLS knowledge (16-17). Each question was worth "1 point", and the evaluation was made over a total of 20 points.

Scale for student satisfaction and self-confidence in learning: It was published by the National League for Nurses (NLN) (18). The scale consists of a total of 13 items in a 5-point Likert scale with two sub-dimensions: "student satisfaction" and "self-confidence in learning". The score is obtained from the sum of the items. The highest possible total score on the scale is 65, and the lowest is 13. A higher total score indicates greater satisfaction and self-confidence. While the internal consistency coefficient of the scale was reported as 0.94 (19), it was found to be 0.90 in the current study.

The Perceived Learning Scale (PLS): It was developed by Rovai et al., (20) and was adapted to Turkish by Albayrak et al., (21). The scale consisted of 9 Likert-type items and three factors: cognitive, affective, and psychomotor. Items 2 and 7 of the scale are scored in the opposite direction. Scores between 9 and 63 are obtained from the scale. Students with higher scores on the scale are interpreted as having higher perceptions of learning. While the internal consistency coefficient of the scale was reported as 0.86 (21), it was found to be 0.70 in the current study.

The semi-structured interview form

The form was created by the researchers to gather students' thoughts, feelings, and experiences regarding the impact of games on learning BLS knowledge and skills (8). The semi-structured interview form consisted of four open-ended questions (Supplementary 1).

Data Collection

The data was collected between September and December 2022. Both groups received three hours of face-to-face BLS training. Before the training, participants' socio-demographic features, BLS knowledge, satisfaction, self-confidence, and perceived learning variables were collected with relevant forms. Afterwards, the researcher showed the BLS application steps to the students in both groups on low-reality mannequins, and all students

performed BLS on the CPR mannequin. Then, the intervention group used the WBSA containing BLS for four weeks. They logged in to the web-based module via remote access using their usernames and passwords. At the end of four weeks, the same measurement tools were used to collect the post-test in both groups. In addition, focus group interviews were conducted with 12 students from the intervention group to discuss their experiences with the WBSA. Three focus group interviews including four students, were conducted by the third author. The duration of each interview were approximately 40-50 minutes. The interviews took place in a quiet room around a round table, and were recorded using a voice recorder. The Consolidated Criteria for Reporting Qualitative Research (COREQ) were followed throughout the qualitative process (22).

Ethical Considerations

All procedures were approved by the ethics committee and the related institution (Decision no 25.11.2021/: 2021-256). The research was conducted in accordance with ethical standards and the principles of the Declaration of Helsinki. All participants were given detailed information about the study and written informed consent was obtained.

Statistical Analysis

The data were presented as frequency, percentage, mean-standard deviation with IBM SPSS 21. The normal distribution of the data was determined by Shapiro-Wilk test. And the independent sample t test was used for intergroup comparisons, and the dependent group T test was used for intragroup comparisons. In dependent variables, comparison should be made by taking the difference between groups. The reliability of the scales was analyzed using Cronbach's Alpha Reliability Coefficient. Pearson Correlation was used to analyze the

relationship between the scales and their sub-scales. The significance level was $p < 0.05$.

The qualitative data were analyzed using the thematic analysis method (23). The transcribed codes were read independently by all three researchers and compared with each other. Finally, the themes, sub-themes and codes were analyzed by an independent researcher (external observer). The three focus groups (FG) were numbered 1-3 and the participants (P) in each group were numbered 1-4 (example: FG.1/P.1). To ensure trustworthiness, we followed four criteria: Credibility, Reliability, Transferability and Confirmability (24).

RESULTS

Quantitative findings

The current study showed that the mean age was 20.62 ± 0.85 for the intervention group and 20.65 ± 0.81 for the control group. In the intervention group, 29 (85.30%) were female, 29 (85.30%) lived in a district or city center, 20 (58.90%) defined their economic status as income equal to expenses, 27 (79.40%) lived in dormitories, and 33 (97.10%) had not received any training on simulation. In the control group, 31 (91.20%) were female, 31 (91.20%) lived in a district or city center, 24 (70.60%) defined their economic status as income equal to expenses, 26 (76.50%) lived in dormitories, and 31 (91.20%) had not received any training on the simulation. Participants' intragroup and intergroup test results were compared. While there was a significant difference between cognitive learning scores and BLS knowledge within the group, no statistically significant difference was found between the groups ($p < 0.05$). Additionally, no significant differences were observed between the two groups in the knowledge, perceived learning, satisfaction, and self-confidence scores of the participants using the WBSA, while the scores of the intervention groups were higher (Table 1).

Table 1. Comparison of nursing students' scores according to their knowledge, perceived learning, satisfaction and self-confidence in learning levels

		Pre-test Mean \pm S.D	Post-test Mean \pm S.D	Test value (In group)
Cognitive learning level	Intervention group	14.02 \pm 1.83	17.53 \pm 2.15	t=- 7.560*** p=0.000
	Control group	13.23 \pm 1.82	16.65 \pm 2.57	t=- 7.167*** p=0.000
	Test value (Intergroup)	t=1.536** p=0.326		
Affective learning level	Intervention group	18.47 \pm 2.21	18,47 \pm 2.67	-
	Control group	17.38 \pm 2.60	17.74 \pm 2.42	t=- 0.877*** p=0.387
	Test value (Intergroup)		t=1.192** p=0.691	
Psychomotor learning level	Intervention group	14.08 \pm 1.35	18.59 \pm 2.31	t= 1.076** p=0.290
	Control group	13.32 \pm 2.27	13.44 \pm 2.11	t= -0.304**p=0.763
	Test value (Intergroup)	t=0.677** p=0.114		
BLS Knowledge level	Intervention group	13.82 \pm 2.32	16.50 \pm 1.50	t=- 6.583*** p=0.000
	Control group	14.00 \pm 2.64	16.03 \pm 2.17	t=- 4.615*** p=0.000
	Test value (Intergroup)	t=1.041** p=0.302		
Scale for student satisfaction and self-confidence in learning	Intervention group	54.47 \pm 8.30	56.71 \pm 4.69	t=-1.615***p=0.116
	Control group	54.82 \pm 4.63	55.71 \pm 4.36	t=-1.057***p=0.298
	Test value (Intergroup)	t=0.911** p=0.366		

SD: Standard Deviation, **Independent sample t test, *** Dependent groups T test

Qualitative Findings

The age range of the students in the focus group interviews was between 20-23, 8 of them were female and 4 were male.

Two themes and four sub-themes were derived from the current study: "Gains from experiences" and "Criticism and development of the application (Figure 5).

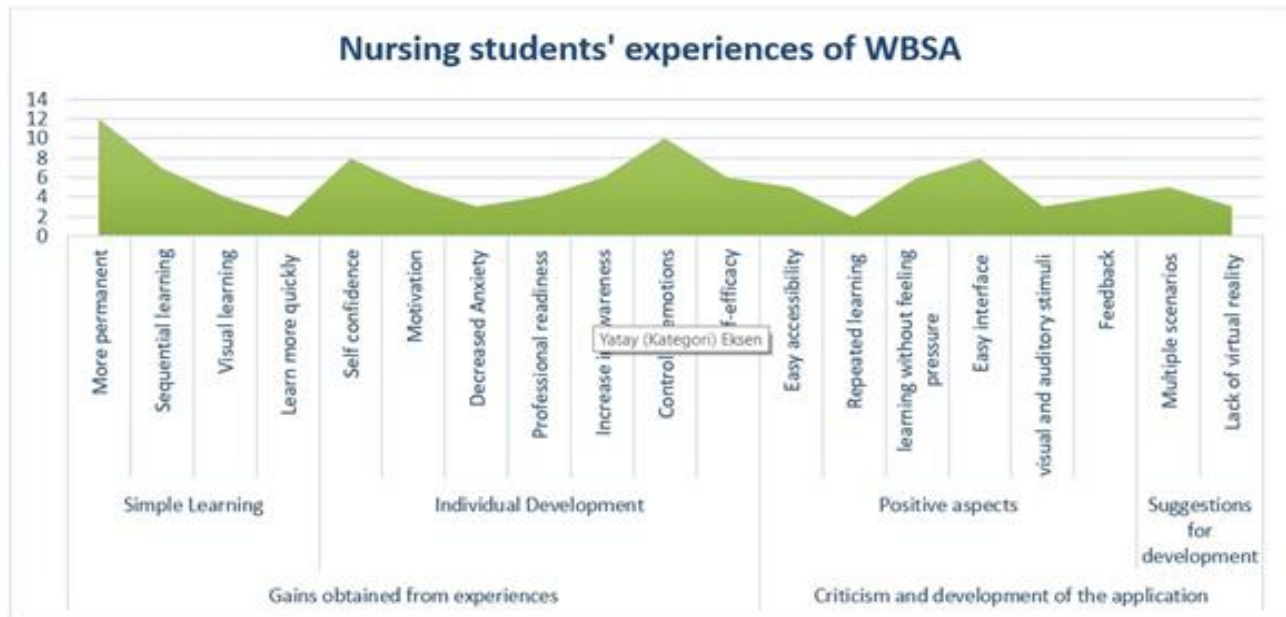


Figure 5. Nursing student's experiences of Web-based simulation application

Theme 1: Gains from experiences

Two sub-themes have been identified regarding this theme: "Simple learning" and "Individual Development". Students expressed that the WBSA reinforced their existing theoretical knowledge, making the information more permanent. Participants mentioned that they struggled with learning the steps of basic life support interventions, and this application supported them in understanding the correct sequence of these steps. Additionally, they noted that because the application is visual, they could better visualize the scenarios in their minds and learn more quickly.

"The practice helped me consolidate my knowledge and learn better. So, I think I will do it confidently when I encounter a real case" (FG.1/P.4).

"Before I played this game, I theoretically knew the application steps, but I was forgetting or confusing the order of what to do first. But after the game, it immediately comes to my mind and I can do it, and this way I get faster" (FG.2/P.2).

According to interviews, the web-based simulation application has highly positive effects on students' individual development. Students reported becoming aware of their individual shortcomings or mistakes and experiencing anxiety about how they might react in similar situations. They also reported significant progress in their readiness and self-efficacy. Some students mentioned that basic life support interventions caused them to feel emotions such as panic, excitement and stress and that the application helped them to control these feelings.

"This application increased my efficiency; I got more efficiency than theoretical courses. Logging into the application as we wish and repeating it again enabled us to improve, I gained practicality, reduced my panic and excitement, that is, I learned to intervene in events directly

and calmly. It was very good for me; it was a good practice and I got a lot of efficiency from it" (FG.3/P.4).

"Using the application increased my self-confidence, I didn't know if I could help, I had prejudices. I was indecisive. But seeing that I can at least learn and do something now has increased my motivation and self-confidence, and I know what to do now. Even if I couldn't do anything, I was able to benefit even in the least way by keeping the calm of that environment and informing 112" (FG.2/P.1).

Theme 2: Criticism and development of the application

Most of the students indicated that they did not encounter difficulties because the application interface was easy to use and accessible. They also noted that the visual and auditory stimuli were effective in supporting their learning and enhancing individual progress. Additionally, they emphasized that the application was repeatable, reinforced learning, and could be used comfortably without an instructor or any sense of pressure.

And participants offered some suggestions to enhance the experience, such as increasing the sense of realism to make them feel more immersed in the app. They also recommended including a wider variety of scenarios on different topics.

"Watching the video was more stimulating in my mind and playing the game was more effective in our learning, we had the opportunity to watch the application over and over again. In this way, we have learned theoretically has become more permanent" (FG.1/P.3).

"We could easily enter the application from a computer or a phone, it was easy to access, the visual and audio effects made it fun, I was impressed" (FG.3/P.3).

"We always proceeded with the same case. After a certain amount of repetition, it started to get boring because we knew the steps. Having different cases would allow us to

think more deeply. For example, it would be great to play this game with babies, children, other age groups, and obese patients “(FG.2/P.3).

DISCUSSION

Game-based learning facilitated the achievement of learning outcomes, especially in the cognitive domain. Studies have shown that game-based learning strategies improve understanding of content and have a more positive effect on knowledge acquisition, knowledge retention, content understanding, critical thinking and clinical reasoning than traditional methods (25-27). It was a significant difference in cognitive learning scores and BLS knowledge within the groups. This situation may be explained that both groups receiving traditional education before intervention. The affective skill is related to feelings, attitudes, affective reactions, empathy, confidence and satisfaction. The goal of the game is to enhance learning and influence nursing students' behaviors, ultimately leading to better clinical outcomes for patients in practice. In the literature, some research results showed that game-based learning has increased student satisfaction and led to positive changes in emotions. However, few studies have focused on behavioral learning outcomes. Qualitative studies showed that virtual game simulation can provide experiential learning opportunities that promote self-confidence and self-efficacy and contribute to teamwork skills (25,26).

In the psychomotor learning domain, there is no haptic feedback function in the web-based computer application that allow users to touch, see, and feel the skin. Therefore, integrating the 3D environments and devices into games has become popular and better prepare them to cope in the real situation (28,29). Using the web-based computer strategies combined high-fidelity manikin and CPR feedback devices in BLS education effect students' performance and improve resuscitation skills or performance such as compression depth, hand placement (28-30). In line with our findings, the lack of significant psychomotor score improvements in the intervention group may be stem from the computer-assisted application not being integrated with a mannequin. This may also be due to the lack of realism of the developed game and the less advanced technology used. Similarly, studies have shown that simulation methods support both technical and non-technical skills such as teamwork, critical thinking, self-confidence, satisfaction, self-efficacy, clinical and communication skills (11-13,30). Additionally, the students reported increased awareness, professional readiness, and emotional control. In the literature, most of the studies reported some positive aspects of game-based learning; interesting, authentic and promoting deep thinking, easy to use, realistic, clinically relevant, motivating and with an appropriate level of complexity for users, relaxed environment, the opportunity for repetition (4,31,32). However, the lack of realism, immediate feedback and technological issues constituted a barrier to learning. A previous study specified that a web-based nursing action simulation-based learning method and learning from case studies based on real patients in hospitals helps nursing students to gain competency problem-based approach learning approach (10). Our qualitative findings align with the existing literature, and students suggested incorporating multiple scenarios with

diverse patient groups in such games. Increasing research on the impact of computer-based games in basic life support education will lead to a deeper understanding of the subject.

The current study has several limitations. First, the study was implemented with nursing students in a single center. Second, students used the program individually and were monitored by the researchers only through the system. Lastly, variations in application usage among students may impact the results.

CONCLUSIONS

In the current study, no significant differences were found between the groups in terms of perceived learning, knowledge, satisfaction, and self-confidence scores. However, the post-test scores of the WBSA group were higher than the control group. The use of web-based computer simulation was effective in enhancing students' individual development and learning. When examined in detail, such programs supported students' self-directed learning and positively influenced their satisfaction and self-confidence. It is recommended to increase the number of follow-up studies with qualitative and quantitative designs.

Competing interest

The authors declare they have no conflict of interest.

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Clinical Trial Number

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