Effectiveness of the Use of Animation and Gamification in Online Distance Education During Pandemic

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The study aimed to determine the effects on knowledge and motivation of animation and gamification in online distance education for a diabetes nursing course. This study was a randomized, controlled, prospective study implemented with 70 nursing students. The animation and gamification were applied to the experimental group. Data were collected using the "Diabetes Nursing Knowledge Test," "Instructional Materials Motivation Survey," and "Opinion Form on Diabetes Education Supported by Digital Instruments." There was a statistical difference between the Diabetes Nursing knowledge scores of the groups after the course ($P < .05$). The students in the experimental group had significantly higher attention and satisfaction and total scores from the Motivation Scale for Teaching Material sub-dimensions compared with the control group ($P < .001$). The results of our study in generation Z nursing students demonstrated that the use of animation and gamification in online distance learning in nursing students increased their knowledge as well as motivation.

KEY WORDS: Animation, Distance education, Game-based learning, Kahoot!

COVID-19 has caused substantial differences in all aspects of life, especially in health systems.[1] Forced to switch to the distance education, nursing education is one of the most affected areas. Teaching continued under unusual and unplanned conditions using available resources in this new state of the world. Difficulties have been experienced in maintaining the education curriculum via online distance education, and nurse educators had to develop appropriate strategies to manage these challenges.[2,3]

The online distance education model utilizes information technologies to establish communication between educators and students.[4] The urgent transition to online distance education due to the COVID-19 pandemic did not offer the educators time to decide the most accurate method, and thus a complex model that led to limited one-to-one interaction with students emerged. Prolonged distance education is thought to impair students' motivation and cause difficulties in the learning process.[5] Poor motivation to learn and absence of student engagement in the teaching environment became a fundamental problem in online distance education, which is a product of revolutionary digital progresses.[6]

The aim of nursing education is to provide the student with basic knowledge, skills, and attitudes in the cognitive, affective, and psychomotor fields.[7] Significant innovations were required in the teaching of these fields in order to be sufficient in this period when nursing education was carried out remotely. Online symposiums have been organized by the "Turkish Nursing Education Program Evaluation and Accreditation Association" and "Nursing Education Association" with the aim of improving remote nursing education in Turkey. The roadmap for maintaining the quality of nursing education during the COVID-19 pandemic was discussed in these meetings.[8] In a workshop with nursing students, they were asked their expectations from educators to increase their motivation for distance education. Most of the respondents stated that "Enriching the course content (animation videos, interactive video, reinforcement questions, use of audio-visual materials, question-answer and survey applications, etc)" and "Developing technology use skills in the distance education process and using Web 2.0 instruments more effectively" would help.[9] It is clear that digital instruments should be used to promote online learning and maintain educator-student interaction in the distance education system. This requires going beyond the methods used in face-to-face education during the long periods the students are kept in front of the screen. It is important to make the most effective use of the digital opportunities of our age by using animation and gamification to make the course content interesting.[10,11]

Animations are widely used educational instruments in teaching technical or non-technical skills in nursing education.[12,13] Visualization with these instruments is reported to

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increase both the motivation and participation of students.[10] Gamification or game-based learning concept refers to the use of game instruments in various real-life activities. Through games, it encourages students to a specific thinking process to actively involve them in problem-solving activities.[13] Gamification emerges as an effective teaching approach as it makes the activities perceived as boring and difficult for the learner fun, provides motivation, and makes the learning process more attractive and active. Kahoot!, a Web 2.0 instrument, is one of the applications that can gamify a content or an activity.[10,13] Nursing students are known to be motivated mostly by internal goals and least by exam anxiety.[14] Previous studies have reported that giving the students the chance to choose their own paths, providing trial-and-error opportunities, providing alternative ways of measuring and evaluating the course, and a rewarding and competitive environment positively affect learning.[4,10,15,16]

Taking these as a starting point, the study aims to determine the effects of using animation and gamification in online distance education of the diabetes nursing course on knowledge and motivation.

METHODS
Study Design
The study was designed as a randomized controlled experimental study. It was structured in accordance with the Consolidated Standards of Reporting Trials Checklist. The received Clinical Trials registration number was NCT05015738.

Hypotheses
The following are the study hypotheses:

Hypothesis 1: Using animation- and gamification-based learning activities in online distance education in the diabetes nursing course would be effective in improving nursing students' knowledge.

Hypothesis 2: Using animation- and gamification-based learning activities in online distance education in the diabetes nursing course would be effective in improving nursing students' motivation.

Participants
The population of the research consisted of students registered in the Diabetes Nursing course in the Nursing Department of a university in Istanbul, Turkey, between December 2020 and February 2021. The researcher teaches the Diabetes Nursing course as this is her academic speciality. The research was therefore conducted during this course. Inclusion criteria for the study were being 18 years old and over, having the means to access distance education (personal computer, Internet connection, etc), not being a Health Vocational High School graduate, being registered for the first time in Diabetes Nursing course, fully participating in the interventions to be

applied in the study, and volunteering to participate in the study.

Using the G*Power 3.1 program (Heinrich Heine University, Dusseldorf, Germany), the sample size was determined as 78.[17] The sample size was calculated to provide a 95% confidence interval and $\alpha = .05$. The number of participants to be included in the study was determined as 78 with an effect size of 0.5. The power of the analysis was found to be 89.6% with this sample size. Eight students who did not meet the sampling criteria of the study were excluded. The study was thus completed with 70 students who met the inclusion criteria. The flowchart of the research is given on the basis of Consolidated Standards of Reporting Trials (see Supplemental Digital Content 1, http://links.lww.com/CIN/A160).

Randomization
For randomization of the study, students were assigned to the experimental (n = 35) and control (n = 35) groups according to their numbers in the class list using the www.random.org program.

Intervention
Diabetes Nursing is a theoretical course given for two course hours. During the pandemic period, the course continued with online distance education, and intervention was made in this period. After they were randomly assigned to the groups, how the study would be conducted was explained to the students. The students were instructed to limit their interaction between the groups regarding the teaching techniques used in the study, and their consent was obtained.

Control Group Intervention
Only the teaching methods such as PowerPoint presentation (Microsoft Inc., Redmond, WA), lecture, and question and answer were used when teaching the Diabetes Nursing course to the control group.

Experimental Group Intervention
An animated video was shown to the students in the experimental group at the beginning of the lesson (see Supplemental Digital Content 2, http://links.lww.com/CIN/A161). Afterwards, the lesson continued with teaching methods such as direct lecture and question-answer over Microsoft PowerPoint presentation. Web 2.0 instrument "Kahoot!" was used at the end of each lesson to reinforce students' learning (see Supplemental Digital Content 3, http://links.lww.com/CIN/A162).

All animations were prepared by the researchers who created the training content to reflect all diabetes guidelines[18,19] and consensus reports.[20] The Powtoon program, which is frequently used in educational technologies, was preferred to create the animations.[21,22] The scenario of the animation

video was created based on the content of each training. The storyboards featured in the videos and animations were developed by researchers and computer experts (two software specialists, three computer programmers). A professional actor voiced the animation video in Turkish. A total of nine animated educational videos were prepared, lasting 18 minutes, including educational topics (see Supplemental Digital Content 2, http://links.lww.com/CIN/A161).

The Web 2.0 instrument "Kahoot!" is a game-based student response system that helps students to remember what they have learned by integrating it with standard exam methods and using gamification techniques and mechanics.[6] Game-based student response systems include a gamification approach that uses game principles and student response systems instruments to support learning, engagement, motivation, and enjoyment in the learning process. The Kahoot application features image content related to the question, motivating music adjusted to the time students have to answer, and game elements such as matching the answer with colorful and shaped buttons, countdown, and so forth.[23] At the start of the study, a trial test with 10 questions independent of the course topic was applied after informing the students in this group about the use of Kahoot!. Thus, students got familiar with, for example, entering the code required to access the Kahoot! platform, the method they will use in choosing the right options, and time use. At the end of each lesson, 10 multiple-choice (with four options) questions created in line with the literature on the subject by taking expert opinions were asked using Kahoot!. Sixty seconds were allowed for each question (see Supplemental Digital Content 3, http://links.lww.com/CIN/A162).

Data Collection Instruments

Data collection was carried out using the "Socio Demographic Information Form," "Diabetes Nursing Course Knowledge Test," "Instructional Materials Motivation Survey," and "Opinion Form on Diabetes Education Supported by Digital Instruments." Data collection was completed via Google Forms. Before starting the research, the students who volunteered to participate for the study filled in the introductory information form after providing their written consents. At the study end, the knowledge and motivation levels of both groups were measured. The students in the experimental group were asked their opinions about the teaching methods.

Socio Demographic Information Form

This form included some demographic information (age, sex, annual income, place of accommodation).

Diabetes Nursing Course Knowledge Test

It was developed by the researchers in line with the current literature to evaluate the relevant information about diabetes nursing.[18–20] The questions were in agreement with the test preparation technique and were submitted to the opinion of the experts. The test consists of 40 multiple-choice questions with 2.5 points each. Kuder-Richardson-20 formula was used to calculate the reliability score, and Kuder-Richardson-20 reliability analysis was used to examine the internal consistency between test scores. The reliability coefficient of the 40-item knowledge test was found to be 0.812 in this study.

Instructional Materials Motivation Survey

This survey consisted of a 33-item measurement instrument with four dimensions that evaluates the entire course and aims to measure the motivation with the teaching material. The survey was developed by Keller with reference to the ARCS (Attention, Relevance, Confidence, Satisfaction) model and was validated in Turkish by Dincer and Doğanay.[24] The original scale studied with the university students has 36 items. It is a 5-point Likert-type scale. The highest score obtainable from the overall scale is 165, and the lowest is 33, with higher scores indicating increased motivation towards the teaching material. The Cronbach's α value for the overall scale is 0.96. The Cronbach's α value of the scale was found to be 0.82 in this study.

Opinion Form on Diabetes Education Supported by Digital Instruments

The interview guide was developed by researchers based on the literature review. This form consisted of four open-ended questions to evaluate the opinions and suggestions of the students in the experimental group about animation- and gamification-supported education, teaching method, and digital education materials.

Ethical Considerations

Ethical approval was obtained from the Ethics Committee (Number 2021/7) of Istanbul Medeniyet University. Students were informed about all stages of the research. Written consent was obtained from the students who agreed to participate. The animations were shared in the control group at the end of the course.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 16 (IBM Inc., Armonk, NY). Shapiro-Wilk test results demonstrated a non-normal data distribution; therefore, the Mann-Whitney U test was used to determine differences. Statistical significance was set at $P < .05$ with a 95% confidence interval.

RESULTS

When the demographic data were analyzed, no statistically significant difference was found between the groups ($U = 0.406$, $P > .05$). The mean age of the students in the

Table 1. Comparison of Knowledge Score Averages From the Diabetes Nursing Course According to Groups

Groups Scale	Intervention Group (n = 35) Median, 25th/75th Percentile	Control Group (n = 35) Median, 25th/75th Percentile	Test Value *U*	*P*
DNCK Test	70.5, 58.5/83.5	47.5, 15/58.5	−5.25	**.026**

Abbreviations: DNCK, Diabetes Nursing Course Knowledge; n, number of participants; *U*, Mann-Whitney *U* test.

experimental group was 20.95 ± 0.81 years; 78.3% were female, and 21.7% were male. The mean age of the students in the control group was 20.48 ± 0.78 years, and 81.2% were female. Most of the students' families were living in a major city.

Diabetes Nursing Course Knowledge Test Score

Table 1 shows the Diabetes Nursing course knowledge scores according to groups. After the lesson, there was a statistically significant difference between the groups in favor of the experimental group in terms of the knowledge scores of the students ($P < .05$).

Instructional Materials Motivation Survey

It was determined that the students in the experimental group, in which the teaching method using animation and gamification was applied, had significantly higher attention and satisfaction and total scores from the Motivation Scale for Teaching Material sub-dimensions compared with the control group using the traditional education method ($P < .001$) (Table 2).

Students' Opinions and Suggestions on Diabetes Nursing Course Supported by Animation and Gamification

Thirty-one students (96.87%) answered "very good, fun"; "very understandable"; "easy to learn"; "enjoyable and instructive." Whereas 93.75% of the students did not offer suggestions, 6.25% of the students told that "there could have been more test questions and animations could

have been shorter." Their further comments are shown in Table 3.

DISCUSSION

The study was carried out in a school year during which the impact of the pandemic was still the strongest and there were several uncertainties, with full lockdown measures being implemented in our country. The negative effects of the pandemic on people from all walks of life are known to affect all of their activities in their everyday lives. At the beginning of this period of sudden transition from traditional face-to-face education to virtual platform, nursing education was continued with the known teaching techniques, and this entered the literature as the concept of emergency remote education.[25] However, as the pandemic was prolonged, the lessons continued with online distance education, and as a result, students had to spend increasingly more time online, and thus, the concept of Zoom fatigue began to be investigated.[26] A study conducted with nursing students demonstrated that Zoom fatigue was real and may have adverse consequences on nursing students. Nurse educators, dealing with increasingly more tired and unmotivated students in this period, clearly saw the need to develop new strategies.[8,9,27,28] The results of our study using animation and gamification methods with the generation Z nursing students who were in fact born into technology showed that the use of animation and gamification in online distance learning in nursing students increased their knowledge as well as motivation.[29–31]

Table 2. Comparison of Score Averages From the Instructional Materials Motivation Survey According to Groups

Groups Scale		Intervention Group (n = 35), Mean (SD)	Control Group (n = 35), Mean (SD)	*U* *P*	95% CI (Lower-Upper)
IMMS	Attention	30.00 (3.95)	18.82 (6.21)	−6.033 **.00**	8.68–13.65
	Relevance	32.28 (2.10)	32.11 (1.98)	−0.329 .74	−0.80 to 1.14
	Confidence	35.91 (6.08)	36.71 (6.46)	−0.205 .83	−3.79 to 2.19
	Satisfaction	26.85 (3.15)	22.05 (3.34)	−4.773 **.00**	−3.24 to 6.35
	Total	125.05 (7.36)	109 (10.55)	−5.379 **.00**	11.00–19.68

Abbreviations: CI, confidence interval of the difference; IMMS, Instructional Materials Motivation Survey; n, number of participants; *U*, Mann-Whitney *U* test.

Table 3. Students' Opinions and Suggestions on Diabetes Nursing Course Supported by Animation and Gamification

	Positive Opinions	Negative Opinions	Suggestions
Teaching method	"Diabetes, which is an important health problem, was gamified in a very entertaining and educational way and it's being supported by animations made it easy for us to understand." "It was really a fun, effective, unusual training." "It was nice and so much fun. We learned while having fun. I wish every lesson could be like this. A suitable education for the generation Z."	"It is difficult to follow, and I can't concentrate on education because the Internet may be cut off."	"There could have been more test questions and animations could have been shorter."
Digital education materials	"The animations were very colorful and interesting." "The most effective materials were used for our learning during the Covid-19 period. It was beautiful and enjoyable." "My favorite thing was to watch the animation and play with the Kahoot! app. I really, really liked it. I didn't even realize how the time passed in the classroom." "The subject was explained with a very nice animation using understandable language. We reinforced our knowledge by competing while playing the game (Kahoot!)." "It was very catchy and fun."	—	"They sometimes had a hard time focusing because the animations were long and suggested that they could be shorter."

Em dash (—) means there is no negative opinion.

There have been reports of positive cognitive outcomes achieved in learners with the inclusion of technology in teaching methods.[32] As a matter of fact, teaching requires increasing students' motivation and engagement, making the learning process and instruments more interesting and fun and the learning experience sustainable.[31,33,34]

In our study, the students who used animation and gamification had a significant difference in the total score of the Instructional Materials Motivation Survey and the satisfaction and attention sub-dimensions of the scale. A qualitative study conducted to investigate the experiences of students in the distance education system identified the sub-theme of "adaptation and focus problems."[35] In this study, the experimental group had a higher score from the "attention" sub-dimension of the Instructional Materials Motivation Survey compared with the control group, suggesting that this approach helped them focus by reducing the dullness of the lesson. In addition, positive statements were used to describe this teaching method such as "very good, fun"; "very understandable"; "easy to learn"; "enjoyable and instructive." Although colorful animations make the digital environment engaging, the time used for this must be kept at an optimal level. A few students stated that they had difficulty focusing on the 18-minute animations. This finding will be an important guide for future studies.

From systematic reviews conducted to evaluate online distance education in nursing education, it appears that students' satisfaction levels about online distance education are high, and they generally make positive comments.[32,36] Common themes such as "improving their learning" and "being able to work at their own pace" were noted in students' statements about Web-based activities. Some studies have reported that it is effective in improving knowledge and skills[29,30] in nursing education and supports problem-based learning.[31]

The outcomes of the education also encompass preparing nurse educators to online distance education and creating environments and proving necessary technological support that fosters digital learning and teaching. We think that developing teaching materials suitable for the curriculum by making use of different disciplines and utilizing distance education in addition to traditional methods under the leadership of nurse educators will be supportive in eliminating the deficiencies. To provide the quality of online nursing education, it is necessary to initiate e-learning in faculty training and development programs.

CONCLUSION

Use of technologies such as animations, Web 2.0 instruments, and multimedia in the education of students seems to be effective in improving the knowledge and increasing the motivation and dedication of learners. We think that technologies such as gamification and animation should be used to improve learning, even when schools switch back to face-to-face education. The limitation of our study is that students' knowledge and motivation levels were not measured with a pretest.

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