Clinical and Experimental Health Sciences

Effectiveness of Diabetes Nursing Course Designed With Hybrid Learning Pedagogy: A Pilot Study

Gulten Karahan Okuroglu, Sule Ecevit Alpar

Marmara University, Faculty of Health Sciences, Department of Nursing, Istanbul, Türkiye.

Correspondence Author: Gulten Karahan Okuroglu
E-mail: gulten.karahan@marmara.edu.tr
Received: 17.09.2021 **Accepted:** 10.03.2022

ABSTRACT

Objective: This study aimed to examine the effectiveness of hybrid learning pedagogy in a redesigned diabetes nursing course for senior nursing students in enhancing knowledge and skills related to diabetes education.

Methods: A single-group pre-test and post-test quasi-experimental design were used. The study was conducted between January-June 2018 in a state university's nursing department in Istanbul, Turkey. Sixteen senior nursing students were included in the sample group of the study.

Results: It was detected that the Insülin Injection Skill Checklist (II-SC) post-test score, Blood Glucose Measurement Skill Checklist (BGM-SC) post-test score, and Educational Skills Checklist (ESC) post-test score were significantly higher than the pre-test scores. There was a significant difference between the Mini Exams (ME) pre-test and post-test scores of participants for each online lesson.

Conclusions: The study results showed that a hybrid learning-based diabetes nursing course effectively increases the knowledge and skills of students regarding diabetes education.

Keywords: Diabetes education, hybrid learning, nursing education, nursing student.

1. INTRODUCTION

Diabetes mellitus is a significant health problem in Turkey and throughout the world because of the frequency of occurrence (1). Nurses play an essential role in the self-management training of individuals with diabetes in health care settings (2). However, studies show that nurses and nursing students have inadequate knowledge about diabetes and its management (3-8). Whereas, healthcare professionals should be owned with the basic knowledge and skills about diabetes care and management (9). Providing a significant role for nurses in training individuals with diabetes and their families to manage diabetes can only be achieved through an effective training program that will make nursing students acquire diabetes knowledge and skills during undergraduate education (10). Graduation of students from the undergraduate program with insufficient knowledge and skills will lead to inexpert nurses who provide inadequate education for patients with diabetes (9).

The rapid developments in science and internet technologies influence the methods and strategies used to increase training programs' effectiveness. Hybrid learning is just one of these innovations in teaching-learning processes (10). In the literature, the concepts of "blended learning", " hybrid learning" or "mixed mode teaching" are used interchangeably. The concept "hybrid learning" was used in this study.

Hybrid learning is defined as learning activities that involve a systematic combination of face-to-face and technology-based interactions between students and teachers, and it is an increasingly widespread approach in the education and training settings (11). This method intends to apply by combining the advantages of face-to-face learning and online learning and minimizing their disadvantages. Face-to-face lessons of the hybrid learning process are maintained through classroom activities, whereas a learning management system (LMS) is used in the distance education dimension. The LMSs are software that enables users to present learning material and course content over the web, evaluate students' performance and monitor their participation. In addition, these systems allow faculty members to assign homework, organize exams and give feedback to students (12,13). Hybrid learning pedagogy has been successfully used in nursing education (14,15) and in various courses such as ethics,

DOI: 10.33808/clinexphealthsci.996865

clinical education, research, and evidence-based nursing (16-19). On the other hand, McCutcheon et al. (2015) emphasized that is the lack of strong evidence on the implementation of a hybrid learning approach in undergraduate nurse education, and they stated that more research is required to assess the effectiveness of the hybrid learning (20).

The Diabetes Nursing Course based on Hybrid Learning Pedagogy (HLP-DE) aims to improve or update senior nursing students' knowledge and skills who take an intern program to gain more competence in a field. Thus, this course will contribute to the education and counseling skills of nursing candidates who will be working in the care of people with diabetes after graduation. The following hypotheses were tested in the study;

- H1: Hybrid learning-based diabetes nursing course increases senior nursing students' knowledge of diabetes
- H2: Hybrid learning-based diabetes nursing course increases the diabetes related skills of senior nursing students

2. METHODS

2.1. Aim

This study aimed to examine the effectiveness of hybrid pedagogy in a redesigned diabetes nursing course for senior nursing students in enhancing knowledge and skills related to diabetes education.

2.2. Study design, setting, and sample

In this study, the single group pre-test post-test quasi-experimental design was used. The study was conducted between January-June 2018 in a state university's nursing department in Istanbul, Turkey. All students who preferred the diabetes nursing intern program in the spring semester were invited to the study. 16 senior nursing students were included in the study sample group. In this study, using the G*Power-3.1 program was tested after the study analysis whether the sample size was sufficient at the 95% confidence level. According to the results of posthoc power analysis, the power of the research is 0.76 according to the smallest difference value; it was determined to be 0.90 according to the largest difference value (Table 3, Table 4).

2.3. Instruments

***2.3.1. Achievement Test**:* The Achievement Test (AT) consisted of 40 multiple choice questions created by Okuroğlu and Alpar (2019) (21). The test evaluates the theoretical knowledge gain after completing the online module. Okuroğlu and Alpar calculated the reliability of AT with the Kuder Richardson-20 (KR-20) formula and reported KR value of AT for health professionals was 0,75. In this study, the reliability coefficient of the AT was higher (KR-20 = 0.84) (22).

2.3.2. Mini Exams (ME): Researchers prepared mini exams to evaluate learning after every online lesson. Mini-exams included ten multiple-choice questions that were implemented online before and after every lesson and assessed 100 points. Those who scored 80 points or higher were considered successful and could continue to the next lesson.

***2.3.3. Insulin Injection Skill Checklist (II-SC)**:* This tool was created by Okuroğlu and Alpar (2019) (21). The tool consists of 21 process steps. The Kendall Tau coefficient had calculated for the reliability of this form and indicated as 0.93 (22).

2.3.4. Blood Glucose Measurement Skill Checklist (BGM-SC): This checklist was created by Okuroğlu and Alpar (2019) (21). The tool consists of 12 process steps; the Kendall Tau coefficient had calculated for the reliability of this form and indicated as 0.87 (22).

***2.3.5. Educational Skills Checklist (ESC)**:* Researchers developed this tool to evaluate educational skills, including pre-training preparation, planning, implementation, and post-training evaluation of nursing students who take diabetes nursing course. The tool consisted of 14 items scored as 1 to 3 (must be improved-adequate-good). The Kendall Tau coefficient was calculated 0.79, indicating that the reliability of the form was "excellent" (22).

2.3.6. Hybrid Learning Satisfaction Questionnaire (HLSQ): This questionnaire has evaluated students' satisfaction with the course and their likelihood of taking future classes with hybrid instruction. The tool consisted of 5 items, and the items have scored from 5 (strongly agree) to 1 (strongly disagree).

2.4. Interventions

In the current curriculum, Diabetes Nursing Course are included within the intern nursing program's scope, theoretical lesson 2 hours and clinical practise at the hospital 24 hours a week. Theoretical lessons are carried out with face to face method. In this study, the Diabetes Nursing Course was redesigned based on hybrid pedagogy.

The online learning part of hybrid learning was carried out with the Online Diabetes Platform (ODP) (www.onlinediyabet.com), which has been developed by the researchers and proven to be effective. ODP includes five modules and thirteen lessons enriched with videos and animations. It also provides online exam opportunities (23). Face-to-face lessons were held in the classroom the week after each online module was completed. The Diabetes Nursing Course Based on Hybrid Learning Pedagogy (HLP-DNC) content was presented in Table 1.

The study process was completed in three stages. In the first stage, pre-test data were collected with AT, II-SC, BGM-SC, and ESC. Task trainers (models) were used in the skill lab to assess students' insülin injection and blood glucose measurement skills, and their performance was observed via checklists. Then, students were asked to prepare and present a patient education. During this performances, students' educational skills were observed via ESC.

Table 1. *The curriculum of the diabetes nursing course based on hybrid learning pedagogy*

Moduls	Weeks	Lessons	Subjects	Learning Method
MODUL I: Definition of Diabetes	1.Week	Lesson 1	Definition, Diagnosis and Classification	Online Learning
		Lesson 2	Pathophysiology, Screening and Prevention	Online Learning
	2.Week			Face to Face Learning
MODUL II: Diabetes Treatment	3.Week	Lesson 3	Self Monitoring	Online Learning
		Lesson 4	Medical Nutrition Therapy in Diabetes	Online Learning
		Lesson 5	Physical Activity and Exercise in Diabetes	Online Learning
	4.Week			Face to Face Learning
	5.Week	Lesson 6	Non-Insulin Antihyperglycemic Drugs	Online Learning
	6.Week	Lesson 7	Principles of Insulin Therapy	Online Learning
	7.Week			Face to Face Learning
MODUL III: Complications of Diabetes	8.Week	Lesson 8	Acute Complications of Diabetes	Online Learning
		Lesson 9	Chronic Complications of Diabetes	Online Learning
	9.Week			Face to Face Learning
MODUL IV: General Health Advices in Diabetes	10.Week	Lesson 10	Foot Care	Online Learning
		Lesson 11	Diabetes and Special Conditions	Online Learning
		Lesson 12	General Health Advices	Online Learning
	Week			Face to Face Learning
MODUL V: Diabetes Education	Week	Lesson 13	Patient Education and Counseling in Diabetes	Online Learning
	Week			Face to Face Learning
	Week	Presentation of Sample Patient Trainings		

In the second stage, a password was given to the students to access the online learning platform at www.onlinediyabet.com. Students completed MEs before and after each online course. Face-to-face courses were held the week after each online module. In the face-to-face courses, the topics were repeated as summaries; the questions that the students did wrong in the MEs were explained, the subjects that the students did not understand were asked and re-explained. The program completed in the thirteenth week, and students presented their diabetes patient training samples in the fourteenth week.

In third stage, post-test data were collected. The presentation performances of the students were evaluated via the ESC (post-test). Students's theoretical knowledge gain was measured via AT (post-test). Insülin injection and blood glucose measurement skills of students were observed using SCs in the skill lab (post-test). Also students' satisfaction with the HLP-DNC was evaluated with HLSQ. Finally, pre-tests and post-tests scores were compared for AT, SCs, and ESC. Besides, pre-test and post-test MEs scores were compared for each online lesson.

2.4. Statistical analysis

The Statistical Package for the Social Sciences program (IBM Corporation, Armonk, NY, USA) was used for the data evaluation. Besides basic statistical calculations, the Wilcoxon's Signed Rank test and Mann–Whitney U-test were used. All the results were considered meaningful at $p < 0.05$ and a confidence interval of 95%.

2.5. Ethical considerations

This study was approved by Ethics committee of Marmara University Medicine Faculty (approval date and no: 09.2018.363). Also, all the participants were informed about the study and written informed consent was obtained from the participants volunteering to participate in the study.

3. RESULTS

The sample group consisted of 16 senior nursing students, and their mean age was 20.31±0.79 years. Most of the participants were females 93.8% (n = 15). Only 25% (n=4) of participants had previous experience in diabetes education (course, symposium, congress). All of the participants had internet access (n = 16, 100%). Each participant spent an average of 3.12±1.54 hours daily using the internet. All of the participants completed the online lessons (n= 16, 100%) and most of the participants attended face-to-face lessons (n = 14, 87.5%). (Table 2).

The results of the analysis made to compare the pre-intervention and post-intervention AT, II-SC, BGM-SC, ESC and ME scores of the study group are presented in Table 3. There was a significant difference between the AT pre-test and post-test scores of participants ($Z = -3.522$; $p = 0.000$). It was detected that the II-SC post-test score was significantly higher than the II-SC pre-test score ($Z = -3.531$; $p = 0.000$). Similarly, it was determined that the BGM-SC post-test score was significantly higher than the BGM-SC pre-test score ($Z=-3.601$; $p = 0.000$). There was a significant difference between the ESC pre-test and post-test scores in the sample group. The ESC post-test score was significantly higher than the ESC pre-test score ($Z=-3.535$; $p = 0.000$) (Tablo 3). Also, there was a significant difference between the ME pre-test and post-test scores of participants for each online lesson ($p < 0.01$) (Table 4).

Table 2. *Demographic characteristics of the participants (n = 16)*

Characteristics	n (%)
Age	
Mean (SD)	20.31 (.79)
Range	19-22
Gender	
Female	15 (93.8)
Male	1 (6.2)
Previous experience with diabetes education (Lesson, symposium, congress)	
Yes	4 (25)
No	12 (75)
Access to the internet	
Yes	16 (100)
No	0
Number of hours spent on the internet daily	
Mean	3.12 (1.54)
Range	1-6
Completing of all online activities	
Yes	16 (100)
No	0
Attendance of all face-to-face lessons	
Yes	14 (87.5)
No	2 (12.5)
Level of Hybrid Learning Satisfaction	
Mean	4.93 (.25)
Range	4-5

Table 3. *Comparison of achievement test, insulin injection skill checklist, blood glucose measurement skill checklist, educational skills checklist pre-test post-test scores of the study group (n: 16)*

Results	Pre-test	Post-test			Post-hoc	
	Median (Q1-Q3)	Median (Q1-Q3)	*Z*	*p*	*Effect size*	*Power*
Achievement Test	25.00 (22.12-30.00)	90.00 (81.87-94.37)	-3.522	0.000*	0.88	0.89
Insulin Injection Skill Checklist	48.00 (42.00-53.50)	63.00 (60.00-63.00)	-3.531	0.000*	0.88	0.89
Blood Glucose Measurement Skill Checklist	24.00 (24.00-27.00)	36.00 (36.00-36.00)	-3.601	0.000*	0.90	0.90
Educational Skills Checklist	19.50 (13.50-24.00)	36.00 (33.00-39.00)	-3.535	0.000*	0.88	0.89

*Wilcoxon Signed Ranks Test was used; Q1: First quarter, Q3: Third quarter; *p<0,01*

When students' respond to the items in the HLSQ are examined, it was seen that the averages of the points are 4.93±0.25 (range=4.00-5.00) (Table 1).

Table 4. *Comparison of the mini exam scores of the study group before and after online lessons (n: 16)*

Subjects	Pre-test	Post-test			Post-Hoc	
	Median (Q1-Q3)	Median (Q1-Q3)	*Z*	*p*	*Effect size*	*Power*
Definition, Diagnosis and Classification	40 (60-80)	100 (100-100)	-3.10	0.002*	0.77	0.88
Pathophysiology, Screening and Prevention	60 (80-95)	100 (100-100)	-2.71	0.007*	0.67	0.80
Self Monitoring	25 (40-75)	100 (100-100)	-3.08	0.002*	0.77	0.88
Medical Nutrition Therapy in Diabetes	60 (80-95)	100 (100-100)	-2.72	0.006*	0.68	0.81
Physical Activity and Exercise in Diabetes	65 (80-100)	100 (100-100)	-2.58	0.010*	0.64	0.76
Non-Insulin Antihyperglycemic (Oral Antıdiabetıc and Insulin-Mimetic) Drugs	20 (40-75)	100 (100-100)	-2.95	0,003*	0.73	0.85
Principles of Insulin Therapy	40 (60-75)	100 (100-100)	-2.95	0.003*	0.73	0.85
Acute Complications of Diabetes	40 (40-55)	100 (100-100)	-2.91	0.004*	0.72	0.84
Chronic Complications of Diabetes	20 (20-40)	100 (100-100)	-3.13	0.020*	0.78	0.89
Foot Care	25 (60-100)	100 (100-100)	-2.55	0.011*	0.68	0.81
Diabetes and Special Conditions	25 (60-75)	100 (100-100)	-2.95	0.002*	0.73	0.85
General Health Advices in Diabetes	60 (80-80)	100 (100-100)	-3.13	0.002*	0.78	0.89
Patient Education and Counseling in Diabetes	65 (80-95)	100 (100-100)	-2.75	0.006*	0.69	0.82
Total	58.46 (53.07-65.38)	100 (100-100)	-3.06	0.002*	0.76	0.88

*Wilcoxon Signed Ranks Test was used; Q1: First quarter, Q3: Third quarter; *p<0,01*

4. DISCUSSIONS

Hybrid learning approach is defined as the integration of face-to-face and online learning environments (24,25). This study aimed to examine the effectiveness of hybrid learning pedagogy in a redesigned diabetes nursing course for senior nursing students in enhancing theoretical knowledge and skills related to diabetes education. When the mean scores of the students after the intervention were evaluated, it was seen that they had a score close to the maximum scores (Table 3, Table 4). Therefore, these mean scores met the instructor's expectations, and the learning outcomes of the course. So, it is possible to say that the students successfully completed this course.

In many studies conducted in different areas where the effectiveness of the hybrid learning model has been investigated, it has been stated that hybrid learning increases theoretical success (26,27). Kurt et al. (2017) said in a meta-analysis study that mixed learning significantly increased students' theoretical success in various fields such as medicine, education, and technology sciences (26). Farzi et al. (2020) stated that hybrid learning as a new educational strategy can improve nurses' performance and reduce medication errors (28). Liu et al. (2016) stated that hybrid learning appears to be more effective than nonhybrid instruction for knowledge acquisition in health professions (29). Zhan et al. (2017) stated that hybrid learning was more effective in increasing primary health care workers' theoretical knowledge about public health services (2017). Li et al. (2019) noted that hybrid learning effectively increases nursing students' knowledge in a meta-analysis study (31). Similarly, Sung, Kwon & Ryu (2008) evaluated the hybrid learning model's effectiveness to increase nursing students' knowledge and skills regarding medication management (32). They stated that the students' knowledge level increased after education. This study's results are consistent with those of the study of Sáiz-Manzanares, Escolar-Llamazares, & Arnaiz González (2020), in which the hybrid learning assesses the impact of nursing students on learning outcomes (33). In this study, the participants' diabetes theoretical knowledge score was higher than before the training (Table 3). Also, there was a significant difference between the ME pre-test and post-test scores of participants for each online lesson (Table 4). This finding showed that training based on the hybrid learning method effectively increases nursing students' theoretical knowledge about diabetes.

Knowledge and skill are two crucial parts of nursing education. Diabetes education includes many skills that should be gained by nursing students. In recent years, many limitations have arisen regarding clinical application areas. This situation has created the need to support the clinical skills of students further (20). In this study, the effects of hybrid learning on students' diabetes-related skills were also examined (Table 3). It was found that the hybrid learning increased the scores of nursing students' insulin injection and blood glucose measurement skills. Tokunaga, Yamaguchi & Yamamoto (2017) stated that the hybrid learning more effective than the face-to-face learning method in nursing skill practice in Japan (34). Alvarez, Dal Sasso & Iyengar (2017) and Verkuyl et al. (2016) used hybrid learning-based mobile applications in pain assessment courses. Both of the studies stated that hybrid learning was useful to increase nursing students' pain assessment skills (35,36). Shorey et al. (2018) explained that nursing students had enhanced communication skills after the hybrid learning process in their study (15). The study results of Strickland, Gray & Hill (2012) indicated that hybrid learning helped students understand and use their research skills in a practical way (37).

Nurses must have educational skills to perform effective diabetes education. For this reason, it is essential to provide nursing students with educational skills during undergraduate education. This study also focused on improving nursing students' educational skills by hybrid learning based diabetes training. The results showed that the post-training educational skills score of students was higher than the pre-training score (Table 3). Choi used hybrid learning and Kim (2018) in a study focused on building competency in nursing students' health education (38). Findings from this study indicate that a hybrid learning approach enhanced student ability to teach patients. Also, Wu et al. (2020) stated in their research that clinical teaching designed with hybrid learning increased nurse educators' clinical teaching competencies (27). These findings show that hybrid learning is useful in acquiring educational skills.

It was determined that students reported high levels of satisfaction with hybrid learning based diabetes nursing course (Table 1). This study concurred with some of the previous research (19,39).

4.1. Limitations

The study population was restricted to the nursing department's students of one state university in Turkey. Therefore, it may limit the generalizability of the study. One of the limitations of the study is the lack of a control group. The sample size may be small, as the students taking a one-semester course are included in the study. Hence, educators and management should exercise caution when applying the results of this study.

5. CONCLUSIONS

In this study, it was determined that a diabetes nursing course designed according to hybrid learning pedagogy effectively increased students' theoretical knowledge and skills about diabetes and gave them educational skills. It was also observed that the students reported a high level of satisfaction with this course designed with hybrid learning.

It is recommended to use hybrid learning in the design of different courses in the nursing curriculum. Also, it is recommended to conduct randomized controlled studies with larger sample sizes in the future. Moreover, the researchers

can conduct studies that were taken feedback from patients taught by the students.

Funding: None

Conflict of interest statement: All authors state that they have no conflict of interest

REFERENCES

[1] The Society of Endocrinology and Metabolism of Turkey (SEMT). Clinical practice guideline for diagnosis, treatment and follow-up of diabetes mellitus and ıts complications –12th ed. Ankara: Bayt; 2019.

[2] Hollis M, Glaister K, Anne Lapsley J. Do practice nurses have the knowledge to provide diabetes self-management education?. Contemp Nurse. 2014;46(2):234-241.

[3] Chan MF, Zang YL. Nurses' perceived and actual level of diabetes mellitus knowledge: results of a cluster analysis. J Clin Nurs. 2007;16(7b):234-242.

[4] Gerard SO, Griffin MQ, Fitzpatrick J. Advancing quality diabetes education through evidence and innovation. J Nurs Care Qual. 2010;25(2):160-167.

[5] Modic MB, Vanderbilt A, Siedlecki SL, Sauvey R, Kaser N, Yager C. Diabetes management unawareness: what do bedside nurses know? Appl Nurs Res. 2014;27:157–161.

[6] Tawalbeh L, Gharaibeh B. Diabetes knowledge among university nursing students in the North of Jordan. Pak J Nutr. 2014;13(12):728.

[7] Yacoub M, Demeh W, Darawad M, Barr J, Saleh A, Saleh M. An assessment of diabetes-related knowledge among registered nurses working in hospitals in Jordan. Int Nurs Rev. 2014;61(2):255–262.

[8] Alotaibi A, Al-Ganmi A, Gholizadeh L, Perry L. Diabetes knowledge of nurses in different countries: An integrative review. Nurse Educ Today. 2016;39:32-49.

[9] Ramjan LM, Watanabe H, Salamonson Y. Diabetes knowledge and perceptions among nursing students, and curriculum differences in Japan and Australia: A cross-sectional study. Nurse Educ Today. 2017; 53:7-12.

[10] Friesen, N. Report: Defining blended learning (cited: 29 September 2016) Available from: http://learningspaces. org/papers/Defining_Blended_Learnin g_NF.

[11] Bliuc AM, Goodyear P, Ellis RA. Research focus and methodological choices in studies into students' experiences of blended learning in higher education. Internet High Educ. 2007;10 (4):231–244.

[12] Aydın CÇ. Biroğul S. E – öğrenmede açık kaynak kodlu öğretim yönetim sistemleri ve Moodle. Bilişim Teknolojileri Dergisi, 2008; 1(2): 31-36 (Turkish)

[13] İşman A. Distance learning. 4th Ed. Ankara: Pegem Academy; 2011. (Turkish).

[14] Ireland J, Johnson N, Adams D, Eboh W, Mowatt E. Blended learning in education: effects on knowledge and attitude. Br J Nurs. 2009;18(2):124–130.

[15] Shorey S, Kowitlawakul Y, Devi MK, Chen HC, Soong SKA, Ang E. Blended learning pedagogy designed for communication module among undergraduate nursing students: A quasi-experimental study. Nurse Educ Today. 2018;61:120-126.

[16] Hsu LL. Blended learning in ethics education: a survey of nursing students. Nurs Ethics. 2011;18(3):418–430.

[17] Rowe M, Frantz J, Bozalek V. The role of blended learning in the clinical education of healthcare students: a systematic review. Med Teach. 2012; 34(4):216–221.

[18] Li Z, Tsai MH, Tao J, Lorentz C. Switching to blended learning: the impact on students' academic performance. J Nurs Educ Pract. 2014;4(3):245–251.

[19] Jang HJ, Hong, SY. Effect of blended learning in nursing education. International Journal of Multimedia and Ubiquitous Engineering 2016;11(5):297–304.

[20] McCutcheon K, Lohan M, Traynor M, Martin D. A systematic review evaluating the impact of online or blended learning vs. face-to-face learning of clinical skills in undergraduate nurse education. J Adv Nurs. 2015;71(2):255-270.

[21] Okuroğlu GK, Alpar ŞE. Effect of Web-based diabetes training program on diabetes-related knowledge, attitudes, and skills of health professionals: A randomized controlled trial. Jpn J Nurs Sci. 2019;16(2):184-193.

[22] Büyüköztürk Ş. Data analysis handbook for social sciences. 10th ed. Ankara: Pegem; 2009. (Turkish)

[23] Okuroğlu GK, & Alpar ŞE. Development of a web-based diabetes education program for health care professionals. J Contin Educ Nurs. 2016;47(10):464-471.

[24] Bielawski L, Metcalf DS. Blended eLearning: Integrating Knowledge, Performance Support, and Online Learning. 2nd ed. Amherst: HRD; 2005.

[25] O'Byrne WI, Pytash KE. Hybrid and blended learning. J Adolesc Adult Lit. 2015;59(2):137–140.

[26] Kurt S.Ç, Yıldırım İ, Cücük E. The Effects of blended learning on student achievement: a metaanalysis study. H. U. Journal Of Education. 2017; 33(3):776-802.

[27] Wu XV, Chi Y, Selvam UP, Devi MK, Wang W, Chan YS, Wee FC, Zhao S, Sehgal V, Ang NKE. A clinical teaching blended learning program to enhance registered nurse preceptors' teaching competencies: pretest and posttest study. J Med Internet Res. 2020;22(4):e18604.

[28] Farzi K, Mohammadipour F, Toulabi T, Heidarizadeh K, Heydari F. The effect of blended learning on the rate of medication administration errors of nurses in medical wards. Iran J Nurs Midwifery Res. 2020;25(6):527-532.

[29] Liu Q, Peng W, Zhang F, Hu R, Li Y, Yan W. The effectiveness of blended learning in health professions: systematic review and meta-analysis. J Med Internet Res. 2016;18(1):e2.

[30] Zhan X, Zhang Z, Sun F, Liu Q, Peng W, Zhang H, Yan W. Effects of improving primary health care workers' knowledge about public health services in rural china: a comparative study of blended learning and pure e-learning. J J Med Internet Res. 2017;19(5):e116.

[31] Li C, He J, Yuan C, Chen B, Sun Z. The effects of blended learning on knowledge, skills, and satisfaction in nursing students: A meta-analysis. Nurse Educ Today. 2019;82:51-57.

[32] Sung YH, Kwon IG, Ryu E. Blended learning on medication administration for new nurses: integration of e-learning and face-to-face instruction in the classroom. Nurse Educ Today. 2008;28(8):943-952.

[33] Sáiz-Manzanares MC, Escolar-Llamazares MC, Arnaiz González Á. Effectiveness of blended learning in nursing education. Int J Environ Res. 2020;17(5):1589.

[34] Tokunaga K, Yamaguchi Y, Yamamoto M. The evaluation of nursing students to nursing skill practices using the blended learning in Japan. Int J Learn Teach Educ. Res. 2017;3(1):19-22.

[35] Alvarez A, Dal Sasso G, Iyengar M. Persuasive technology in teaching acute pain assessment in nursing: results in learning based on pre and post-testing. Nurse Educ Today. 2017;50(1):109–114.

[36] Verkuyl M, Hughes M, Tsui J, Betts L, St-Amant O, Lapum L. Virtual gaming simulation in nursing education: a focus group study. J Nurs Educ. 2017;56(5), 274–280.

[37] Strickland K, Gray C, Hill G. The use of podcasts to enhance research-teaching linkages in undergraduate nursing students. Nurse Educ Pract. 2012;12(4): 210-214.

[38] Choi S, Kim Y. Effects of smoking cessation interventions education program based on blended learning among nursing students in South Korea. Osong Public Health Res Perspect. 2018;9(4):185–191.

[39] Zolfaghari M, Negarandeh R, Eybpoosh S. Developing a blended learning program for nursing and midwifery students in Iran: Process and preliminary outcomes. Iran J Nurs Midwifery Res. 2013;18(1):20-26.

How to cite this article: Karahan Okuroglu G, Ecevit Alpar S. Effectiveness of Diabetes Nursing Course Designed With Hybrid Learning Pedagogy: A Pilot Study. Clin Exp Health Sci 2022; 12: 507-513. DOI: 10.33808/clinexphealthsci.996865