# Effect of Application of Digital Game-Based Teaching Method versus Traditional Method on Nursing Students' Performance Regarding Electrocardiogram Procedure

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#### Abstract

Background: The integration of digital game-based learning (DGBL) into nursing education offers innovative opportunities to enhance both theoretical knowledge and practical competencies. Aim: This quasi-experimental study aimed to evaluate the effect of a digital game-based teaching method versus a traditional method on nursing students' knowledge and application of the electrocardiogram (ECG) procedure. Subjects and Method: a purposive sample of 80 second-year nursing students was divided into two groups Tools: I: "Student Interview Structured Evaluation Form" which consisted of two parts; Part (A): Socio-demographic data and Part (B): Students' Knowledge Assessment Sheet. Tool II: "Students practice observational checklists regarding their role towards electrocardiography procedure. Results: revealed that students in the digital game-based group demonstrated significantly higher levels of knowledge and practical performance compared to the traditional group, with sustained retention after one month. A positive correlation between knowledge and practice was also observed in the game-based group. Conclusion: The findings support the effectiveness of DGBL in improving learning outcomes in complex clinical procedures like ECG Recommendations: The study recommends incorporating DGBL as a complementary educational strategy in nursing curricula and encourages further research to explore its longterm impact across diverse clinical contexts.

*Keywords:* Digital game-based learning; Educational technology; Electrocardiogram (ECG); Nursing education.

#### Introduction

Nursing education is a practiceoriented field that is concerned with only not acquiring theoretical knowledge but also the development of psychomotor and critical thinking skills essential for effective clinical practice. Nursing education has long been delivered through traditional lecture-based approaches, in which students passively absorb knowledge. However. these approaches are no longer adequate to meet the demands of modern healthcare or to get nursing students ready for practical settings (Dirgar, Berse, Bor, & Tosun, 2024).

According to constructivist learning theory, students comprehend new information best when it is related to what they already know. This deep understanding is especially important in nursing, where students must recall, connect, and apply essential concepts to ensure patient safety and make informed decisions. Meaningful learning also enables students to confidently manage reallife situations, reinforcing the need for dynamic and practical teaching approaches (Al-Omari, Dorri, Blanco, & Al-Hassan, 2024).

Technological advancements have transformed the educational environment, providing new opportunities for self-directed learning through digital platforms.

Game-based learning (GbL) is an innovative teaching method with beneficial effect. It uses game elements increase to student motivation, engagement, and information retention. Playing games engaging, offers an structured environment that promotes learning in the cognitive, emotional, and psychomotor

# domains.(Gegenfurtner & Kollar, 2025).

According to research educational games are beneficial for teaching healthcare. Research indicates that including gaming element can enhance academic achievement. encourage positive attitudes, lessen anxiety, and encourage active In nursing specifically, learning. Gamification has been associated with enhanced clinical decisionmaking, communication, confidence, and time management (Vázquez-Calatayud, 2024). Additionally, students often report greater satisfaction and motivation when learning through games, especially in complex or essential subjects like pharmacology or ECG procedures (Haque, Asif, Pandey, & Dixit, 2025).

The electrocardiogram (ECG) is an essential non-invasive diagnostic technique for tracking heart function and identifying arrhythmias. In

clinical settings, nurses are often the first health care provider to respond to patient needs and play a key role in initiating and managing ECG procedures. This includes using ECG equipment, ensuring correct lead placement, performing the initial interpretation, gathering pertinent and quickly data, alerting the attending physician enable to appropriate medical decisions

# (Yang, Chung, & Chen, 2022).

As they provide direct patient care, nurses must be competent in both the technical execution of ECGs and data interpretation. However, several studies have identified notable gaps in nurses' ECG related knowledge and procedural skills, highlighting the urgent need for effective educational strategies to enhance their competence and ensure highquality patient care (Yeom, Yang, & Kim, 2020).

# **Research Hypotheses:**

- Students who receive digital gamebased teaching methods about electrocardiogram will exhibit more improvement in performance than students who receive traditional teaching methods.
- Students who receive a traditional teaching method about electrocardiogram will exhibit more improvement in performance than students who receive game-based teaching method.

Game-based learning offers а promising solution by combining theoretical instruction with simulated, hands-on practice in a digital environment. Through game scenarios based on real practical cases, students can enhance their ECG knowledge, strength decisionmaking skills, and gain confidence applying what they learn. in Therefore, integrating game-based leaning into nursing education. especially in essential competencies like ECG interpretation, has the potential to bridge the gap between classroom learning and clinical practice (Xie & Liu, 2024).

The aim of the study: - This study aimed to evaluate the Effect of Digital Game-Based Teaching Method Versus Traditional Method on Nursing Students' Knowledge and Application of Electrocardiogram Procedure

- Subject & Method
- **Design:** A quasi-experimental comparative design was used in this study.
- Setting: The study was conducted at the Faculty of Nursing, Tanta University, Egypt. The data collection and interventions took place in Lecture Hall 4, and the Computer Laboratory room. These settings were chosen to provide an appropriate environment for delivering the educational

interventions and assessing the outcomes effectively. Lecture Hall 4 was utilized for theoretical instruction and discussions while the Computer Laboratory room was used for implementing the digital game-based teaching method.

**Sample** A purposive sample of 80 nursing students from second year were selected and divided into two equal groups; each group consisted of (40) students as the following:

-Study group (I): it consisted of 40 students who received digital game teaching method about ECG procedure.

-Study group (II): it consisted of 40 students who received traditional method about ECG procedure.

The following criteria were used for selected subjects studied: -

-Both sexes

-Student who does not study ECG procedure

Tools of data collection: -

Two tools were used in this study to collect pertinent data: -

**Tool I: "Student Interview Structured Evaluation Form**" This tool was constructed by the researcher to collect baseline data to the current study. It consisted of two parts as follows:

**Part (A): Socio-demographic data.** It was developed by the researcher after reviewing the related literature which includes student code, sex and age (Bayram & Caliskan, 2019),(ABUMETTLEQ et al., 2023).

.Part (B): Students' Knowledge Assessment Sheet: It was developed by the researcher based on reviewing the related literature (Zhang & Hsu, 2013), (Sheilini & Devi, 2014), (Hernández-Padilla et al., 2017). It was used to assess students' basic information about ECG Procedure knowledge. It includes the definition of ECG, supplies of ECG, preprocedure preparation; limb leads number, each limb lead color and site, chest pump number, each chest pump site, interpretation of limb leads, chest leads, shape of ECG wave, and its parts.

#### Scoring system

The knowledge of students was scored as who respond by" choice and correct answer " were given a score of 1, and who respond "wrong and not answer " were given a score of zero.

The total score was calculated and then converted to a percentage out of the maximum possible score as

Poor	<60%.
Fair	60% to 75%.
Good	>75%.

ToolII:"Studentspracticeobservationalchecklistsregardingtheirroletowardselectrocardiographyprocedure:Thispartwasdeveloped

by(Eckman, 2013) and adopted by the researcher, It comprises four phases covering the following: nurses role pre-procedure (eight) steps, nurses role during procedure(nine) steps, nurses' role post-procedure (four) steps, and interpreting the ECG (eight) steps.

**Scoring system**: Each item was scored as follows:

Done correctly assigned a score of (2)

Done incorrectly assigned a score of (1)

Not done will assigned a score of (0)

Total scores were summed up, converted to percentages, and calculated as follows:

- $\geq 80\%$  satisfactory practice level. score  $\geq 46$
- <80% unsatisfactory practice level score < 46.

#### Method

The study was accomplished through the following steps:

#### I -Administrative process:

Approval was obtained from the Dean and Head of Medical-Surgical Nursing Department Tanta at University. Ethical clearance (code 425-3-2024) was secured, and informed consent was taken from all students, ensuring privacy and voluntary participation. Tools were validated by five experts in the field.

# **3-Content validity**

All tools were tested for content validity by five jury of experts in the field of Medical-Surgical Nursing at the Faculty of Nursing.

# II - Operational design:

A pilot study was done on 8 students (excluded from the main sample) to check tool clarity. **Reliability** was confirmed using Cronbach's alpha (Tool I = 0.885, Tool II = 0.922).

**Data collection** lasted 3 months (July–September 2024) from 80 students divided into two equal groups, **Group I** learned via a digital game and **Group II** received traditional teaching.

# It was conducted on four phases as follows: -I. Assessment phase:

Assessment of student was done by researcher After obtaining the informed consent for all the study subjects in both study groups make collection baseline data pertinent by using tool I. Student Interview Structured Evaluation Form: It was used to assess student knowledge regarding ECG procedure first time (pre implementation the study).

**Student Interview Structured Evaluation Form:** It was used to assess student basic knowledge regarding ECG procedure first time (pre implementation the study) second time (immediately after using digital game for study group I and after explain procedure for study group II) and third time (after one month of apply both teaching method)

# **II-Planning phase:**

This phase was formulated based on the study subjects' assessment, use of relevant literature review for design of digital game (Masoumian Hosseini et al., 2023), to assess students need and expected outcome.

**Expected outcomes were included:** -Enhance student understanding and retention of ECG procedure and make students interested while acquiring knowledge.

-Game design: The game was designed through a collaborative effort between the researcher and the game developer It design over a period of 6 months started from the end of November 2023 to the end of May 2024. Creating a web-based game involved а seamless integration of three fundamental web technologies: HyperText Markup Language (HTML), Cascading Style Sheets (CSS), and JavaScript. **HyperText** Markup Language (HTML) was utilized to structure the content of the game. It provided the foundational framework by defining elements such as buttons, images, and text, which are essential for user interactio. Cascading Style Sheets (CSS) was employed to enhance the visual appeal and user experience. It allowed us to style the game

elements, ensuring a cohesive and aesthetically pleasing design. CSS enabled the customization of fonts, lavout. colors. and animations. making the game more engaging and visually attractive. JavaScript, a dynamic programming language, was the core technology that brought interactivity to the game. By leveraging JavaScript, we were able to implement game logic, respond to user actions, and manipulate HTML elements in real time. This included creating functions for game mechanics, tracking user input, and updating the game state. Using JavaScript, we ensured that the game responded to user actions promptly, providing a seamless and interactive experience. The combination of these technologies was critical in developing a functional, responsive, and visually appealing web-based game. HTML laid the groundwork, CSS enhanced the user interface, and JavaScript provided the necessary interactivity, resulting in a wellrounded and engaging gaming experience. This approach not only the demonstrates power of integrating web technologies but also highlights the importance of each technology in contributing to overall web the success of development projects.(Ranjan et al., 2020),

# III-Implementation phase: Content of the Digital Game The Digital game was comprised of (4) main Stages:

- **Stage I** pre-procedure preparation: remove metal objects, remove chest hair and Prepare ECG machine. Notification (hints) was act like a help to aid students to complete stage and ensure that information is received.
- Stage II Drag Limb leads: four colored limbs led each of it to attach to a specific limb. Starting from left lower limb the nursing students will select the (green) lead to be dragged to its site, then upper left limb (yellow), and then right upper limb (red) and then to right lower limb(black) to be pointed digitally. Notification (hints) was act like a help to aid students to complete stage and ensure that information is received.
- Stage III Drag Chest-Pump: six chest pumps are attached to the patient's chest; each of them has a specific site. Starting from v1 at fourth intercostal space right to sternum border, then v2 at fourth intercostal space left to sternum border, then v4 at fifth intercostal space at the mid clavicular line, then v3 between v2 andv4, then v5 at fifth intercostal space at the anterior axillary line, and then v6 at fifth intercostal space at the mid axillary

line to be pointed digitally. Notification (hints) acted like help to aid student to complete stage and ensure that information is received.

- **Stage IV** Displaying ECG cardio electrical wave by clicking on the power button and explaining the interpretation of Limb leads, chest leads shape of ECG wave and its parts to identify normal from abnormal.

 Score was given according to the time taken to accomplish each stage. Total score was 100 divided into (4) stages to be each stage 25.

- Maximum time allowed for completing each stage (5) minutes.
- Score given for complete each stage with (1) mint was (25), with (2) mint was 20, with (3) mint was 15, with (4) mint was 10, with (5) mint was 5
- Students were not allowed to progress to the next stage unless they answered the current stage correctly.
- A Score was given to motivate students to replay
- After successfully completing each stage, a banner appeared with the text "Well Done," accompanied by a motivational sound and a checkmark.
- Google sheet was used to assess student sign in and score Study Group (I):
- Study group was enrolled in digital game teaching through link present in device of computer laboratory

them Where students engage in the game stage in case of delayed response from student notification(hints) was appeared to notify students what to do according to the time taken for the answer scoring was given to students as follow.

- Total score is 100 divided into (4) stages to be each stage 25.
- Maximum time allowed for completing each stage (5) minutes.
- Score given for complete stage with (1) mint was (25), with (2) mint was 20, with (3) mint was 15, with (4) mint was 10, with (5) mint was 5.
- This scoring motivates students to replay and improve their performance
- They also received a link to the digital game which allowed them to practice it at home.

#### **Study Group (II):**

- Studied group who received traditional teaching method using PowerPoint, whiteboard, whiteboard marker and mannequin for explain ECG procedure.

Both study groups were informed that they would receive a certificate of appreciation for their participation in the training. Additionally, their performance would be evaluated and assessed, and those who achieved the best performance would be rewarded with monetary prizes after finishing study all students in both groups will receive same teaching methods to avoid bias.

#### **IV- Evaluation phase:**

Every student in Both groups (I and II) assessed as following by **Tool I** was concerned with assessment of students' Knowledge regarding ECG and **Tool II** was concerned with assessment of students' practice regarding ECG procedure immediately and after one month from the applying the Study.

#### Results

Table (1): Distribution of thestudied nursing students regardingtheirsocio-demographiccharacteristics.

It represented that the most common age group among students is 19 years, representing 82.5% in Group I and 85.0% in Group II.

**Regarding to gender**, Females are more prevalent in Group I (60%) but slightly less in Group II (47.5%). Conversely, males are more frequent in Group II (52.5%) compared to Group I (40%).

**Regarding residence,** In Group I, there is an equal distribution between rural and urban areas (50%). Meanwhile In Group II, there is a slight increase in rural students (60%) compared to urban students (40%). There were no statistically significant differences between both groups found

Table (2): Distribution of the studied nursing students regarding their total knowledge level about ECG procedure among the studied groups throughout periods of teaching methods. It was found that pre implementation of the intervention 100% of students in both studied groups had poor knowledge (<60% score). And 100% students of reached good a knowledge level (>75% score) in both studied groups with mean 28.03±1.097, 27.20±1.506 for Group I (digital game) and Group II (traditional method) respectively but Group I significantly outperformed Group II (**P** = 0.000).

While Knowledge retention remained good in category, with Mean,  $28.23 \pm 0.480$  for Group I (Digital Game-Based Method) after one month of intervention. As compared to Group II (Traditional Method) a Slight decline in retention with Mean,  $25.43 \pm 2.099$ . That indicates Group I retained higher scores than Group II, showing better long-term retention. P = 0.000

Figure (2) The changes in the mean total knowledge scores about ECG procedure among the studied groups throughout periods of teaching methods.

.It show that pre implementation of the intervention both groups had low baseline knowledge scores below (5), indicating limited prior of understanding the ECG procedure. And there was а significant improvement in knowledge in both groups immediately after the intervention, with mean scores rising above 25.

While, one-month post-intervention Group I (digital game-based) maintained a high and relatively stable score, whereas Group II (traditional teaching) showed a slight decline. This indicates that digital game-based teaching may be more effective in supporting long-term knowledge retention.

Table (3): Distribution of the studied nursing students regarding total practice level regarding their role towards ECG throughout periods of teaching methods. It was found that Digital Game-Based Teaching (Group I) Immediately post implementation the intervention 95% of students achieved satisfactory practice levels, with a mean score  $51.10 \pm 2.845$ .

While, One Month Post implementation the intervention 92.5% retained satisfactory levels in study group I (digital game base teaching), showing strong practice retention with a mean score  $51.28 \pm$ 3. 030. As, No significant change over time P = 1.00.

**On another hand,** Traditional Teaching (Group II) Immediately

post implementation of the traditional teaching method 92.5% achieved satisfactory practice levels, with a mean score of  $51.50 \pm 3.803$ .

But. One Month Post implementation of the traditional teaching method 65% retained satisfactory practice levels; there were а significant decline in retention. With Mean score decreased to  $45.85 \pm 2.860$ , as P = 0.000

Figure (3): Distribution of the nursing students studied regarding total practice level regarding their role towards ECG throughout periods of teaching methods.

It showed that Digital Game-Based Teaching (Group I) Immediately post implementation the intervention **95%** of students achieved satisfactory practice levels.

While,OneMonthPostimplementationtheintervention92.5%retained satisfactory levels instudygroup I (digital game baseteaching).

**On another hand,** Traditional Teaching (Group II) Immediately post implementation of the traditional teaching method **92.5%** achieved satisfactory practice levels.

But,OneMonthPostimplementationofthetraditionalteachingmethod65%retainedsatisfactorypracticelevelsand

was a significant decline in retention.

Table (4) Relationship between socio-demographic characteristics of the studied nursing students and their total knowledge score towards ECG among the studied groups throughout periods of teaching methods. It was found that for Effect of Age Immediately Post-Intervention Group I (Digital Game-Based Teaching) Students aged 20 years scored slightly higher mean score  $(28.33 \pm 0.577)$  than those aged 18 years mean score (28.25 ± 0.500), but the difference is not statistically significant ( $\mathbf{F} = 1.405$ ,  $\mathbf{P}$ = 0.258).

Also, it remains unchanged for One Month Post-Intervention, with students aged 20 retaining higher scores (28.15  $\pm$  0.650), but the differences are still nonsignificant (F = 1.405, P = 0.258). While Group II (Traditional Teaching) shows No significant differences across age groups at any stage (P > 0.05), indicating age does not impact outcomes under traditional teaching methods.

Regarding Effect of Gender, Group Game-Based Ι (Digital Teaching) Immediately Post-Intervention the Females  $(28.29 \pm$ 0.464) perform slightly better than males  $(28.13 \pm 500)$ , but the difference is not statistically

significant as P = 0.288.but, One Month Post-Intervention the males start to score slightly higher, with no significant difference as P = 0.051.. while Group Π (Traditional Teaching) Immediately Post-Intervention shows the Females  $(27.32 \pm 1.493)$  perform better than males  $(27.10 \pm 1.546)$ , but the difference is not statistically significant P = 0.650.

Also, One Month Post-Intervention: Females continue to perform slightly better, but differences remain nonsignificant P = 0.071.

**Regarding Effect of residence,** Group I (Digital Game-Based Teaching) shows Immediately Post-Intervention: Urban students (28.15  $\pm$  0.489) perform slightly lower than rural students (28.30  $\pm$  0.470), but the difference is not statistically significant P = 0.329.

Also, One Month Post-Intervention there was No significant differences between urban and rural students.

Meanwhile, Group II (Traditional Teaching) shows Immediately Post-Intervention that Urban students score significantly higher (27.63  $\pm$  1.258) than rural students (26.92  $\pm$  1.613), with no significant difference P = 0.147.

Also, One Month Post-Intervention there was No significant differences between urban and rural students. Table (5): Relationship betweensocio-demographic characteristicsof the studied nursing studentsand their total practice scoretowards ECG among the studiedgroups throughout periods ofteaching methods.

It was found that Group I (Digital Game-Based Teaching) shows a significant age-related difference in practice scores both immediately and after one month, with 20-year-olds consistently scoring higher. While Group II (Traditional Teaching) shows No significant age differences.

**Regarding Effect of gender**, Group I shows No significant gender differences, indicating equal effectiveness for males and females. While Group II shows Males initially outperform females, but the gap disappears after one month.

**Regarding Effect of residence,** Group I shows No significant differences between rural and urban students. While Group II shows that urban students perform slightly better, but the difference.

Table (6): Correlation betweentotal knowledge scores of thestudied nursing students and theirtotal practice role towards ECGthroughout periods of teachingmethods. It was found that forGroup I (Digital Game-BasedTeaching) Immediately Post-

Intervention there was a positive significant correlation between knowledge and practice scores, statistically significant ( $\mathbf{r} = 0.385$ ), ( $\mathbf{P} = 0.014$ ). Also, the correlation strengthens One Month Post-Intervention, there was a high positive significant association ( $\mathbf{r} = 0.447$ ),  $\mathbf{P} = 0.004$ .

Meanwhile, Group II (Traditional Teaching) shows Immediately Post positive Intervention a weak correlation ( $\mathbf{r} = 0.227$ ), which is not statistically significant Р = 0.158.Also, the correlation weakens one Month Post-Intervention  $(\mathbf{r} =$ statistical 0.075), with no significance P = 0.646.

	The nursing students studied (n=80)							
Characteristics	Study group I(n=	=40)	Study group	۸ P				
	N	%	N	%	1			
Age (in years)								
18	4	10.0	0	0.0	2 571			
19	33	82.5	34	85.0	2.371			
20	3	7.5	6	15.0	0.337			
Gender								
Male	16	40.0	21	52.5	FE			
Female	24	60.0	19	47.5	0.370			
Residence								
Rural	20	50.0	24	60.0	FE			
Urban	20	50.0	16	40.0	0.500			

Table (1): Distribution of the studied nursing students regarding their socio-demographic characteristics.

FE: Fisher' Exact test

(Table2) Distribution of the studied nursing students regarding their total knowledge level about ECG procedure among the studied groups throughout periods of teaching methods.

		The studied nursing students (n=80)												
Total knowledge level	N	Pre %	Im	mediatel y %	Post a month N %			N	Pre %	Im N	mediatel y %	l r N	Post a nonth %	χ <sup>2</sup> Ρ
Poor	40	100.0	0	0.0	0	0.0	152.76	40	100.0	0	0.0	0	0.0	152.76
Good														
Range	(	0-7)	(	25-29)	(2	27-29)	F=516.54	(	0-7)	(	25-29)	(	22-29)	F=283.68
Mean ± SD	2.1	5±2.13	28.	03±1.097	28.	23±0.48	P=0.000*	1.5	0±2.03	27.	20±1.506	25.	43±2.09	P=0.000*
		1				0	1 00000		8				9	1 00000
Gp I Vs Gp														
II	1	1.39		4.13		6.94								
t	0	.167	(	).000*	0	).000*								
Р		- /												

Gp I (Study group I): receive digital game teaching method about ECG procedure

Gp II (Study group II): receive traditional method about ECG procedure

\* Statistically significant level at P<0.05



Figure (1) The changes in the mean total knowledge scores about ECG procedure among the studied groups throughout periods of teaching methods.

Table (3): Distribution of the studied nursing students regarding total practice level regarding their role towards ECG throughout periods of teaching methods.

	The studied nursing students (n=80)									
Total practice level	Study group I (n=40)				.2	Study group II (n=40)				2
	Immediate ly		Post a month		χ P	Immediate ly		Post a month		λ P
	N	%	Ν	%		Ν	%	Ν	%	
Unsatisfactory										
Satisfactory										
Range Mean ± SD	(42-58) 51.10±2.84 5		(42-58) 51.28±3.030		t=0.071 P=0.79 1	(4 51.	44-58) 50±3.80 3	( 45.	41-52) 85±2.860	t=7.509 P=0.000 *
Gp I Vs Gp II										
t	(	).533		8.235						
Р	(	).596	(	).000*						

<80% Unsatisfactory

≥80% Satisfactory

Gp I (Study group I): receive digital game teaching method about ECG procedure

Gp II (Study group II): receive traditional method about ECG procedure

\* Statistically significant level at P<0.05

FE: Fisher' Exact test



Figure (2): Distribution of the studied students regarding total practice level regarding their role towards ECG throughout periods of teaching methods.

Table (4): Relationship between socio-demographic characteristics of the studied nursing students and their total knowledge score towards ECG among the studied groups throughout periods of teaching methods.

	The studied nursing students (n=80)									
	Total knowledge score									
Characteristics		Study group I		Study group II						
	(n=40)			(n=40)						
	Pre	Immediately	Post a month	Pre Immediately Post a month						
Age (in years)										
- 18										
- 19										
- 20										
F, P										
Gender										
- Male										
- Female										
- t, P										
Residence										
- Rural										
- Urban										
t, P	0.00, 1.00	0.977, 0.329	1.017, 0.319	3.206, 0.081	2.190, 0.147	1.233, 0.274				

**Study group I:** receive digital game teaching method about ECG procedure **Study group II:** receive traditional teaching method about ECG procedure \* Statistically significant level at P<0.05 Table (5): Relationship between socio-demographic characteristics of the studied nursing students and their total practice score towards ECG among the studied groups throughout periods of teaching methods.

	The studied nursing students (n=80)									
	Total practice score									
Characteristics	Study group I		Study group II (n=40)							
	(n=40)									
	Immediately	Post a month	Immediately	Post a month						
Age (in years)										
- 18	49.00±4.830	48.25±4.349	-	-						
- 19	51.61±2.397	51.42±2.750	51.91±3.511	45.62±2.775						
- 20	48.33±2.517	53.67±1.528	49.17±4.875	47.17±3.251						
F, P	3.405, 0.044*	3.322, 0.047*	2.779, 0.104	1.515, 0.226						
Gender										
- Male	51.25±1.807	51.69±2.056	50.43±3.789	45.48±2.502						
- Female	51.00±3.401	51.00±3.551	52.68±3.544	46.26±3.229						
t, P	0.072, 0.789	0.488, 0.489	3.758, 0.060	0.750, 0.392						
Residence										
- Rural	51.15±2.519	51.65±2.540	50.83±3.886	45.17±2.615						
- Urban	51.05±3.203	50.90±3.478	52.50±3.559	46.88±2.986						
t, P	0.012, 0.913	0.607, 0.441	1.886, 0.178	3.657, 0.063						

**Study group I:** receive digital game teaching method about ECG procedure **Study group II:** receive traditional method about ECG procedure

\* Statistically significant level at P<0.05

Table (6): Correlation between total knowledge scores of the studiednursing students and their total practice role towards ECG throughoutperiods of teaching methods.

	The studied nursing students (n=80)							
Total	Total knowledge score							
practice	Study g	group I	Study group II					
score	(n=	40)	(n=40)					
	Immediately	Post a month	Immediately	Post a month				
r	0.385	0.447	0.227	0.075				
Р	0.014*	0.004**	0.158	0.646				

r: Pearson' correlation coefficient

\* Statistically significant level at P<0.05

\*\* Highly statistically significant level at P<0.01

#### Discussion

The integration of digital gamelearning based (DGBL) into educational settings has gained significant attention in recent years, particularly in fields that require practical skills and knowledge. Nursing education, with its focus on theoretical both and practical learning, provides a unique opportunity to explore how gamebased learning can influence students' understanding and application of critical skills (Lee et al., 2024).

This study examined the effect of applying a digital game-based teaching method on nursing students' performance in the electrocardiogram (ECG) procedure, compared to traditional teaching methods. This section discusses the findings in relation to previous studies, highlighting their implications for nursing education and skill development.

The finding of present study regarding age of student revealed that Most of the students were 19 years old, which reflects that they were at the beginning of their university education. This may be attributed to the study conducted on second-year students. This finding was matched with Berg & Steinsbekk (2021) who stated that most studied nursing students were aged less than 20 years old.

Concerning to sex of the participant was a nearly equal distribution of males and females in the digital game-based group, while males were slightly more represented in the traditional group. This could be attributed to the fact that male students were more willing to participate in the study, which increased their number. After the distribution into both groups, their number slightly increased in the traditional group. This finding agreed with Terlecki et al., (2017) who pointed out that the readiness of males to try different teaching methods is greater than that of females.

**Concerning residence,** the sample equally included students from both rural and urban areas, which allowed for a comparison of the impact of the social environment on learning.

In relation to the knowledge level before application of the intervention, it was revealed that both study groups had a poor level of knowledge, which reflects the students' limited understanding of the ECG procedure prior to the implementation of the teaching methods. This also minimized differences between the two groups, reducing bias and enhancing the

generalizability and applicability of the results.

Regarding the immediate impact of the teaching methods, both studied groups achieved a good level knowledge. of However, the improvement observed in the group taught using the digital game-based method was superior to that of the traditional method. This could perhaps be explained by the active learning environment that digital games provide as suggested by (Adipat, Laksana, Busayanon, & Adipat, Asawasowan, 2021), which supports the research hypothesis

This finding agreed with **Boedeker** et al. (2025), who stated that students in interactive sessions achieved higher grades compared to those in traditional lectures.

Similarly, the results of a systematic review conducted by Lee et al., (2024) found that digital serious games can be used more effectively as learning tools in practical courses in theoretical than ones. Furthermore, Gudadappanavar, Benni, & Javali (2021) reported that the knowledge scores of students who were taught using a game-based method were higher than those of students in the traditional teaching group.

of In contrast to the findings Rondon, Sassi, & Furquim de Andrade (2013), who reported that both methods were equally effective, this difference may be explained by the limited time available for students to engage in the game. As in their study, only one computer was available, and each student had to play quickly to give others a turn. Whereas, in our study, a fully equipped computer lab with multiple devices was used, allowing the students to immerse themselves in educational experience.

**Regarding practice performance,** the study found that performance improved immediately in both groups following the implementation of the teaching methods. However, it was noted that most students in the group taught using the game-based method achieved a satisfactory level of performance, whereas more than a third of students in the traditional method group demonstrated an unsatisfactory level of application.

This reflects the positive impact of the game-based teaching method on students. This could be explained by the fact that game-based learning (GBL) has been shown to positively influence motivation by aligning Self-Determination with Theory (SDT), which emphasizes the importance of autonomy, competence, and relatedness in

fostering intrinsic motivation. When GBL meets these psychological needs, it leads to improved performance engagement and (Hwang & Chang, 2024) which supports the research hypothesis This finding is supported by Seong, Cheng, Ling, Krishnan, Zaman, & Lokithasan, (2024), who stated that game-based learning (GBL) has a impact enhancing positive on motivation and fostering students' sense of competence, autonomy, and relatedness. This is further supported by Fulya Eyupoglu & Netfeld (2019), who reported that the competition inherent in game-based learning environments positively influences students' intrinsic motivation.

Similarly, this finding aligns with the results of **Bayram & Caliskan** (2019), who found that the final practical scores of students in the experimental group, which used game-based learning, were higher than the average scores of students in the control group. Also, **Tan, Lee,** et al. (2017) reported that gamebased learning can promote students' psychomotor performance compared to traditional methods.

In contrast to the finding of Butt (2015) who found that the gamebased approach was equivalent to the traditional method in its effect on students' performance in practical procedures. This could be attributed to the difficulties students faced while navigating the game, as many experienced headaches and dizziness during gameplay.

**Regarding student performance** after one month of using both teaching methods, it was found that the levels of knowledge and practice remained stable in the group taught using the digital game-based teaching method. This indicates strong knowledge and skill retention among students. In contrast, students in the traditional teaching group showed a decline in both knowledge and practice. This difference can be attributed to several factors. Firstly, the digital game-based learning environment promotes active learning, where students are engaged in the learning process rather than passively receiving information. (Boedeker et al., 2025). This is with finding agreed Asniza. Zuraidah, Baharuddin, Zuhair, & Nooraida, (2021), who confirmed the positive effect of game-based approaches in enhancing student engagement and active learning.

Secondly, repetition played a crucial role in reinforcing knowledge and skills. Data from Google sheet, which was used to monitor student engagement, revealed that many students repeatedly accessed the game to improve their performance and increase their scores. This aligns with the findings of Verkuyl et al. (2016), whose study indicated that students immersed themselves in the game and were enthusiastic about continuing to play, which made them eager to repeat it in order to finish and score higher.

In Addition, this retention may also be linked to the hedonic factor, which refers to the elements that enhance a learner's experience based on pleasure or emotional satisfaction derived from the learning process (Oluwajana et al., 2019). As stated by Sharma, Tak, & Kesharwani (2020), hedonic value positively impacts the intention to continue playing online games. This includes aspects that make learning more engaging and enjoyable for students, digital as games provide а stimulating enjoyable and experience. engagement Such enhances students' motivation to engage in continuous learning. ultimately contributing to better long-term retention of acquired knowledge and skills as confirmed by (Vaghela & Parsana, 2024).

This finding aligns with **Kulakaç & Çilingir (2024)** who found that retention rates, knowledge test scores, and skill performance were higher in the game-based learning

group compared to the traditional group. Similarly, Pitt, Borman-Shoap, & Eppich (2015) reported well-designed educational that games provide an ideal environment for memory retention by increasing student involvement, motivation. enthusiasm, and interest in the material. In addition, Masoumian Hosseini et al. (2023), provided evidence that game-based instruction demonstrated longer-term sustainability in promoting learning retention compared to traditional instruction.

In contras **Drummond et al. (2017)**, Almashayek, Al-Khateeb, & Bader, (2022), reported that gamebased instruction was ineffective in promoting retention and long-term memory compared to traditional instruction, this could be attributed the students' inability to to repeatedly access the game and engage fully in the learning process in both studies. Whereas in our study the game was open access available for students at any time in any place.

Concerning the relationship between socio-demographic characteristics and total performance the results revealed that socio-demographic characteristics may influence knowledge acquisition and the improvement of practical performanceinlearningelectrocardiogram(ECG)procedures. As the findings showedthat age, sex, and place of residenceimpacted knowledge and practicescores in both studied groups.

Regarding age, the predominance of 19-year-old participants reflects the nature of the sample, which was second-year drawn from undergraduate students, indicating a of homogeneity. degree Nevertheless. differences in knowledge and performance emerged among different age groups, with older students (20 years and above) performing better on some measures. This may be attributed to their higher cognitive maturity and increased ability to benefit active from learning strategies, such as digital games as suggested by(Brod, 2021)

This finding aligns with Valença et al. (n.d.), whose study indicated that game-based learning enhances the engagement of older students, leading to improved academic outcomes. Additionally,

Nadeem, Oroszlanyova, & Farag, (2023) reported that students with a growth mindset are more likely to attempt new approaches multiple times until they succeed contrast, younger students may be more engaged with educational games; however, their lack of prior academic experience may limit their overall benefit from these games (Papastergiou, 2009), resulting in no statistically significant differences between age groups. While, in traditional settings, no clear differences were observed between age groups, suggesting that traditional methods may not provide additional advantages for older students compared to their younger counterparts (Hattie, 2008)

In terms of sex, there was a balanced distribution relatively between males and females in the group that received game-based learning, strengthening internal comparisons. The Females performed better in the game-based learning group. This can be explained by the fact that females are often more committed and engaged with organized and directed activities (Bennett & Maton, 2010). Additionally, well-designed digital games can provide a safe and engaging learning environment that enhances female participation and reduces distractions or stress factors. positively reflecting on their performance. This aligns with Nadeem et al. (2023), who reported female students generally that showed a slightly higher level of toward the enjoyment games compared to male students.

In contrast, Rondon et al. (2013) found that male students learned better through digital games. Therefore, it is recommended to consider gender differences when designing game-based learning activities. This discrepancy may be attributed to the lack of access to physical play within the study setting and the reliance on a single computer, which reduced the level of organization and limited the of structured, presence guided activities, factors that may have particularly affected female students' engagement.

Regarding place of residence, the diversity between urban and rural participants enriched the sample and allowed for the examination of how the social and economic environment affects learning. It was observed that students from urban scored higher in both areas knowledge and practice by traditional learning methods compared to their peers from rural areas. This may be attributed to greater access to transportation for city students, which enables them to easily attend the college for traditional education as evidenced by (Wood, 2023).

However, the difference was less pronounced in the group that used digital games, indicating that this approach may help reduce the educational gap related to place of residence, as it allows for learning without being restricted to a specific location as suggested by (**Tang et al., 2024**). This finding aligns with **Liao, Wu, Gunawan, & Chang,** (2024), who stated that "Games are a promising tool for helping learners in both rural and urban areas to develop their skills."

Regarding the correlation between knowledge and practice, the study results showed a strong positive correlation between the knowledge and practice in the digital gamebased learning group, while this correlation was not observed in the traditional group. This difference can be attributed to Contextual Learning Theory, which suggests that learning involving real and interactive contexts enhances the connection between knowledge and practice as evidenced by (Chuang, 2021). This aligns with Hu (2024), whose study highlighted the importance of digital game-based learning in enhancing contextual understanding and cognitive processes, contributing to creating a meaningful and engaging learning environment. In contrast, the gap between theory and practice in the traditional method significantly impacted this relationship (Saifan et al., 2021) This can be attributed to the continuous feedback, which was

achieved by encouraging banners for good performance, along with an overall final score to assess progress. That plays a significant role in motivating learners and increasing their desire to repeatedly engage with the game. Learners feel a sense of progress and improvement, which enhances their sense of accomplishment and self-motivation. driving them to return and engage with the gam Davidson & Candy's (2016) e repeatedly, as confirmed in study.

This finding aligns with, **Buttussi et al. (2013),** who discuss the role of educational games in improving knowledge and performance, their relationship with enhancing practical application, and their potential for repeated training and practice.

In contrast to the findings of **Tan**, **Lau, et al. (2017),** who found that there was no clear relationship between the knowledge and skills acquired through game-based learning, which can be attributed to the lack of repetition and the absence of feedback.

In the end, the results of this study can highlight the fact that gamebased learning provides an impactful learning experience that promotes active, engaging, and repetitive learning. As well as increasing students' motivation and improves knowledge retention.

#### Conclusion

Based on the finding of current study, it can be concluded that digital game-based learning (DGBL) is effective in enhancing nursing students' knowledge and practical skills. especially complex in procedures like electrocardiogram (ECG). The results support the integration of DGBL as a complementary tool in nursing education, offering more interactive and effective learning experiences in nursing education.

# Recommendation

# For faculty of nursing

Adopt digital game-based learning as a complementary teaching strategy in clinical courses, particularly in complex procedures like ECG, due to its effectiveness in enhancing both knowledge and practical skills.

# For future research

Replicate this study across other nursing faculties and clinical procedures to validate the effectiveness of digital game-based learning in different contexts.

# References

Abumettleq, I., Bayraktar, N., &Dikmen,B.(2023).Effectivenessofgame-basedteachingmethodonnursing

students' knowledge of enhanced recovery after surgery (ERAS).

- Acquah, E. O., & Katz, H. T. (2020). Digital game-based L2 learning outcomes for primary through high-school students: A systematic literature review. *Computers & Education, 143,* 103667.
- Adipat, S., K., Laksana, Busayanon, K., Asawasowan, A., & Adipat, В. (2021). Engaging students in the learning process with game-based learning: The fundamental concepts. International Journal of Technology in Education, 4(3), 542-552.
- Al Omari, E., Dorri, R., Blanco, M., & Al-Hassan, M. (2023). Revolutionizing nursing education: A concept-based approach for enhanced learning. *Middle Eastern Journal of Research in Education and Social Sciences*, 4(4), 1–12.
- Asniza, I. N., Zuraidah, M. O. S., Baharuddin, A. R. M., Zuhair, Z. M., & Nooraida, Y. (2021). Online game-based learning using Kahoot! To enhance preuniversity students' active learning: A students' perception in Biology classroom. Journal of Turkish Science Education. 18(1), 145–160.

- Bayram, S. B., & Caliskan, N. (2019). Effect of a game-based virtual reality phone application on tracheostomy care education for nursing students: A randomized controlled trial. *Nurse Education Today*, 79, 25– 31.
- Bennett, S., & Maton, K. (2010). Beyond the 'digital natives' debate: Towards a more nuanced understanding of students' technology experiences. *Journal of Computer Assisted Learning*, 26(5), 321–331.
- Berg, H., & Steinsbekk, A. (2021). The effect of self-practicing systematic clinical observations in a multiplayer, immersive, interactive virtual reality application versus physical equipment: randomized Α controlled trial. Advances in Health Sciences Education, 26, 667-682.
- Boedeker, P., Schlingmann, T., Kailin, J., Nair, A., Foldes, C., Rowley, D., Salciccioli, K., Maag, R., Moreno, N., & Ismail, N. (2025). Active versus passive learning in large-group sessions in medical school: A randomized cross-over trial investigating effects on learning and the feeling of learning. *Medical Science Educator*, 35(1), 459–467.

- Brod, G. (2021). Generative learning: Which strategies for what age? *Educational Psychology Review*, 33(4), 1295– 1318.
- Butt, A. L. (2015). Exploring the usability of game-based virtual reality for development of procedural skills in undergraduate nursing students [Master's thesis].
- Buttussi, F., Pellis, T., Vidani, A.
  C., Pausler, D., Carchietti, E.,
  & Chittaro, L. (2013).
  Evaluation of a 3D serious game for advanced life support retraining. *International Journal of Medical Informatics*, 82(9), 798–809.
- Chen, T.-S., Hsieh, P.-L., Tung, C. C., Wu, C.-H., & Cheng, Y.-C. (2023). Evaluation of registered nurses' interprofessional emergency care competence through the gamification of cardiopulmonary resuscitation training: A cross-sectional study. BMC Medical Education, 23(1), 359.
- Chuang, S. (2021). The applications of constructivist learning theory and social learning theory on adult continuous development. *Performance Improvement*, 60(3), 6–14.
- Davidson, S. J., & Candy, L. (2016). Teaching evidence-based

practice using game-based learning: Improving the student experience. *Worldviews on Evidence-Based Nursing*, 13(4), 285–293.

- Dirgar, E., Berşe, S., Bor, N. A., & Tosun, B. (2024). The effect of concept mapping in nursing education on critical thinking motivation: A path analysis. *Nurse Education Today*, 143, 106386.
- Drummond, **D.**, Delval, **P.**. Abdenouri, S., Truchot, J., Ceccaldi, P.-F., Plaisance, P., Hadchouel, A., & Tesnière, A. (2017). Serious game versus online course for pretraining medical students before а simulation-based mastery learning course on cardiopulmonary resuscitation: A randomised controlled study. European Journal of Anaesthesiology, 34(12), 836-844.
- Eckman, M. (2013). Lippincott's Nursing Procedures. Wolters Kluwer/Lippincott Williams & Wilkins Health.
- Fulya Eyupoglu, T., & Nietfeld, J.
  L. (2019). Intrinsic motivation in game-based learning environments. In Game-based Assessment Revisited (pp. 85–102). Springer.

- Gegenfurtner, A., & Kollar, I. (2025). Designing Effective Digital Learning Environments. Routledge.
- Gudadappanavar, A. M., Benni, J. M., & Javali, S. B. (2021). Effectiveness of the game-based learning over traditional teaching-learning strategy to instruct pharmacology for Phase II medical students. Journal of Education and Health 10(1). Promotion, https://doi.org/10.4103/jehp.jehp 270 20
- Haque, S., Asif, F., Pandey, P., & Dixit, R. K. (2025). Revolutionizing pharmacology education: Comparing escape rooms and traditional learning on student engagement and wellbeing. *Future Health. Advance online publication.* https://doi.org/10.25259/fh\_61\_2 024
- Hattie, J. (2008). Visible learning: A synthesis of over 800 metaanalyses relating to achievement. Routledge.
- Hernández-Padilla, J. M.,
  Granero-Molina, J., Márquez-Hernández, V. V., Suthers, F.,
  López-Entrambasaguas, O. M.,
  & Fernández-Sola, C. (2017).
  Design and validation of a threeinstrument toolkit for the assessment of competence in

electrocardiogram rhythm *European Journal of Cardiovascular Nursing*, 16(5), 425–434. https://doi.org/10.1177/14745151 16680498

- Hu, Z. (2024). Game-based learning: Alternative approaches to teaching and learning strategies in health sciences. Educational Process: International Journal (EDUPIJ), 13(2), 90 - 104. https://doi.org/10.22521/edupij.2 024.132.1.
- Hwang, G.-J., & Chang, C.-Y. (2023). Facilitating decisionmaking performances in nursing treatments: A contextual digital game-based flipped learning approach. *Interactive Learning Environments*, 31(1), 156–171. https://doi.org/10.1080/10494820 .2021.1987532
- Kulakaç, N., & Çilingir, D. (2024). The effect of a serious gamebased web application on stoma care education for nursing students. *Teaching and Learning in Nursing*, 19(1), e126–e132. https://doi.org/10.1016/j.teln.202 3.10.001
- Lee, M., Shin, S., Lee, M., & Hong, E. (2024). Educational outcomes of digital serious games in nursing education: A systematic review and meta-

analysis of randomized controlled trials. *BMC Medical Education*, *24*(1), 1458. https://doi.org/10.1186/s12909-024-06464-1

- Liao, C.-H. D., Wu, W.-C. V., Gunawan, V., & Chang, T.-C. (2023) Using an augmentedreality game-based application to enhance language learning and motivation of elementary school English as Foreign Language The Asia-Pacific students. Education Researcher, 33(2),307-19. https://doi.org/10.1007/s40299-023-00729-x
- Masoumian Hosseini, M., Sadat Manzari, Z., Gazerani, A., Masoumian Hosseini, S. T., Gazerani, A., & Rohaninasab, M. (2023). Can gamified surgical sets improve surgical recognition instrument and student performance retention in the operating room. BMC Medical Education, 23(1), 907. https://doi.org/10.1186/s12909-023-04680-2
- Nadeem, M., Oroszlanyova, M., & Farag, W. (2023). Effect of digital game-based learning on student engagement and motivation. *Computers*, 12(9), 177.

https://doi.org/10.3390/computer s12090177

- Oluwajana, D., Idowu, A., Nat, M., Vanduhe, V., & Fadiya, S. (2019). The adoption of students' hedonic motivation system model to gamified learning environment. Journal of Theoretical and Applied Electronic Commerce Research, 14(3), 156–167
- Papastergiou, M. (2009). Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation. *Computers & Education*, 52(1), 1–12
- Pitt, M. B., Borman-Shoap, E. C., & Eppich, W. J. (2015). Twelve tips for maximizing the effectiveness of game-based learning. *Medical Teacher*, 37(11), 1013–1017.
- Ranjan, A., Sinha, A., & Battewad,
  R. (2020). JavaScript for modern
  web development: Building a
  web application using HTML,
  CSS, and JavaScript. BPB
  Publications.
- Rondon, S., Sassi, F. C., & Furquim de Andrade, C. R. (2013). Computer game-based and traditional learning method: A comparison regarding students' knowledge retention. *BMC Medical Education*, 13, 1–8.
- Saifan, A., Devadas, B., Daradkeh, F., Abdel-Fattah, H., Aljabery,

M., & Michael, L. M. (2021). Solutions to bridge the theorypractice gap in nursing education in the United Arab Emirates: A qualitative study. *BMC Medical Education*, 21, 1–11.

- Seong, L. V., Cheng, Z., Ling, T. M., Krishnan, S., Zaman, W. K., & Lokithasan, K. (2024). game-based effect of The learning on performance and motivation of university students: exploratory An study. Journal International of Advanced Research in Education and Society, 6(2), 374-388.
- Sharma, T. G., Tak, **P.**, & Kesharwani. A. (2020). Understanding continuance intention to play online games: The roles of hedonic value, utilitarian value and perceived risk. Journal of Internet *Commerce*, 19(3), 346–372.
- Sheilini, M., & Devi, E. S. (2014). Effectiveness of educational intervention on ECG monitoring and interpretation among nursing students. *Journal of Dental and Medical Sciences*, 13(12), 1–5.
- Tan, A. J. Q., Lau, C. C. S., & Liaw, S. Y. (2017). Serious games in nursing education: An integrative review. 2017 9th International *Conference on Virtual Worlds and Games for*

*Serious Applications* (VS-Games), 187–188.

- Tan, A., Lee, C., Lin, P., Cooper, S., Lau, L., Chua, W., & Liaw, S. (2017). Designing and evaluating the effectiveness of a serious game for safe administration of blood transfusion: А randomized controlled trial. Nurse Education Today, 55, 38-44.
- Tang, M., Ren, P., & Zhao, Z. (2024). Bridging the gap: The role of educational technology in promoting educational equity. *The Educational Review, USA*, 8(8).
- Terlecki, M., Brown, J., Harner-Steciw, L., Irvin-Hannum, J., Marchetto-Ryan, N., Ruhl, L., & Wiggins, J. (2017). Sex differences and similarities in video game experience, preferences, self-efficacy: and Implications for the gaming industry. Current Psychology, 30, 22-33.
- Thompson, S. (2012). Sampling (Vol. 755). John Wiley & Sons.
- Vaghela, V., & Parsana, D. (2024).
  Vaghela, V., & Parsana, D. F. (2024). Teaching and Learning: Fostering Student Engagement, Critical Thinking, and Lifelong Learning Skills. http://library.atmiya.net:8080/dsp ace/handle/atmiyauni/1661

Valença, A., Soares, A., Castro, L. D. do B., Lima, M. de, Silva, L. da, & Oliveira, R. de O. (n.d.). The Impact of Game-Based Learning on Student Engagement: A Case Study Using Kahoot! *A Technical Education*. *SSRN*.

https://papers.ssrn.com/sol3/pape rs.cfm?abstract\_id=5042214

- Vázquez-Calatayud, M., García-García, R., Regaira-Martínez, E., & Gómez-Urquiza, J. (2024). Real-world and gamebased learning to enhance decision-making. *Nurse Education Today*, 140, 106276.
- Verkuyl, M., Atack, L., Mastrilli,
  P., & Romaniuk, D. (2016).
  Virtual gaming to develop students' pediatric nursing skills:
  A usability test. Nurse Education Today, 46, 81–85.
- Wood, R. M. (2023). A review of Education differences in Urban and Rural areas. *International Research Journal of Educational Research*, 14(2), 1–3.
- Xie, J., & Liu, J. (2024). The application and practice of gamebased learning in the teaching of game theory: a strategy simulation game to promote the integration of theoryand practice. http://www.upubscience.com/upl oad/20250123155948.pdf

- Yeom, G. J., Yang, J., & Kim, H. S. (2020). Development and effects of supplementary textbook about EKG for nursing students. *Journal of Korean Academy of Fundamentals of Nursing*, 27(3), 268–276.
- Zhang, A., Olelewe, C., Orji, C., Ibezim, N., Sunday, N., Obichukwu, P., & Okanazu, O. (2020). Effects of innovative and traditional teaching methods on technical college students' achievement in computer craft practices. SAGE Open, 10(4), 2158244020982986.