Effect of Applying Blended Problem-Based Learning on Nursing Students' Creativity Levels

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Abstract

Background: Nursing education is strongly affected by the global pandemic known as Covid-19. Coping with this pandemic and other 21st century challenges need graduates who have the ability to think creatively to solve problems. Blended Problem-Based learning is an innovative learning which allows active and flexible learning that improves students' creativity and problem-solving skills. **Aim of the study**: To explore the effect of applying blended problem-based learning on nursing students' creativity levels. **Design**: Quasi-experimental design. **Setting**: Faculty of Nursing, Benha University. **Subject**: Convenient sample of 3rd year nursing students enrolled in the academic year 2021/2022(n=240). **Tools**: Four tools were used for data collection; Knowledge Test about BPBL, Attitude toward BPBL Questionnaire, Perceived Effectiveness of BPBL Questionnaire and Creativity Measurement Questionnaire. **Results:** There was highly statistically significant improvement in mean-scores of nursing students' total creativity levels and also their total levels of knowledge, attitude, and perceived effectiveness regarding Blended Problem-Based Learning after its implementation. Additionally, there were highly statistically significant correlations among students' total levels of knowledge, attitude, perceived effectiveness and their creativity levels. **Conclusion**: Implementing Blended Problem-Based Learning was indicated to be an effective educational approach to improve nursing students' creativity levels. In-addition, it showed promising results in improving nursing students' total knowledge, attitude and perceived effectiveness regarding BPBL and it could be implemented for other nursing subjects in the future. **Recommendations**: Blended Problem-Based Learning should be adopted as a new learning strategy for nursing students. Nursing Educators should be prepared to develop appropriate strategies for coping and engaging students in Blended Problem-Based Learning courses.

Keywords: Blended Learning, Creativity, Nursing Education, Nursing Students, Problem-Based Learning

Introduction

COVID-19 as a worldwide health pandemic had an impact on all sectors of life including nursing education. In coping with this critical condition, all institutions of higher education switched from the traditional face-to-face teaching and learning to the virtual mode **(Agu et al., 2021)**. Several advanced technological teaching methods have been considered to overcome to the problems of students' inability to attend at classrooms such as the use of E-learning platforms and blended learning to improve students' practical skills and to compensate for their limited clinical attendance **(Herliandry et al., 2020).**

To stay up with the fast-paced world of the 21st century, students must acquire a variety of soft skills. As a result, today's nursing educators must use instructional methodologies that encourage students to build digital skills as well as creativity and problem-solving abilities which can be achieved through problem-based learning. Students also must practice information and communication literacy skills, which can be aided by maintaining a blended learning environment **(Arman, 2018)**.

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Blended Problem-Based Learning (Blended-PBL) combines problem-based learning and blended learning to keep up with digital-age learners. It can be an excellent teaching method for students in the twenty-first century who have grown up with technology and the internet. These Blended-PBL learning procedures are designed to address 21st century vital abilities, such as problem-solving, creativity, and technology skills for lifelong learning. Recently, the combination of problem-based learning and blended learning has had many benefits, because learners apply their prior experiences to new material to create new knowledge **(Dawilai et al., 2019)**.

Blended learning is a teaching method that has lately won a good educational reputation and has shown promise in terms of achieving its goals and educating students in ways that are appropriate for their modern lives. It provides faculty students with considerably more flexibility as well as a much deeper and richer learning experience than other instructional approaches **(Turpin, 2018)**.

Blended learning combines face-to-face and online learning which increases access to education for students who need to maintain their learning with other life duties **(Könings et al., 2018)**. It is concerned with the integration of traditional face-to-face training and online learning instructions via self-paced and distant learning using a variety of digital learning modalities. Blended learning also emphasizes the integration of synchronous and asynchronous learning by helping students to communicate with others via many communication channels such as e-mail, discussion boards, chat rooms, and face-to-face communication **(Moebs, 2016)**.

To enhance students' problem-solving skills, an appropriate learning model is needed. Problem-based learning is considered one of the learning models which can not only improve students' problem-solving skills, but also prepare them for real life situations. PBL is an effective strategy for nursing students because it encourages constructive, collaborative, and self-directed learning from realistic experiments related to professional performance facilitating information transfer **(Jong et al., 2017)**. Furthermore, it allows students to gain hands-on experience in problem-solving exercises. It also teaches students how to apply diverse skills, concepts, and abilities that they have acquired to solve issues **(Yew &Goh, 2016)**.

In a brief, PBL is a mode of instruction in which a problem drives the learning to the heart of the course curriculum's primary issues. The PBL paradigm emphasizes learners' active participation by presenting them to an issue, allowing them to actively solve it and then draw conclusions. To summarize, the PBL process entails establishing problems, clarifying terms, brainstorming, organizing, learning objectives, individual study, and synthesis. This method identifies what people already know, defines their learning needs, and the method of getting new information to solve real-life problems **(Kim, 2021)**.

There is a growing need in the 21st century for creativity in health care systems to overcome the challenges of health care happen every day, and also to improve quality of provided care and generates an environment structured to minimize work-related stress **(Cheraghi et ., 2021)**. Creativity plays an important role in helping professional nurses to maintain high-quality of nursing practices. Creativity is known as the steps of producing new and valuable products or services, and encouraging creativity and creative problem solving skills among nursing students leads to students' success not only in their education but also in their work practice **(Liu et al., 2019)**

According to **Bereczki &Karpati (2021)** creativity is broadly defined as an individual

process that involves the creation of new and real products that are novel, original, useful and appropriate in social situations and it is impacted by a variety of factors such as environmental, social and personal. Also, creativity can be defined as thinking about something new, and unique. Moreover, **Liu et al., (2019)** identified creativity as the process of developing something new, innovative and valuable. So, enhancing creativity and problem-solving skills have great importance in improving the nursing students' achievement.

Significance of the Research

The combination of Blended Learning and Problem Based Learning became an educational necessity. Blended learning is combining conventional (face-to-face) learning and online learning. Problem-based learning is an alternative teaching strategy that was developed to treat traditional medical educational failure to develop problem-solving settings **(Son, 2020)**. This learning makes students actively participate in learning and develops their thinking and reasoning skills. Therefore, the combination of both learning models can be a solution to enhance students' creativity **(Nauri et al., 2019)**.

Aim of the Research

This research aimed to explore the effect of applying blended problem-based learning on nursing students' creativity levels.

Research Hypothesis

To achieve the aim of the current study the following hypothesis was formulated;
There would be a statistically significant difference between the mean scores of students' creativity levels on the pre, post and at follow up phases of applying Blended Problem-based learning.

Subjects and Methods

Research Design: Quasi-experimental design was used.

Research Setting: Faculty of Nursing, Benha University.

Research Subject: Convenient sample of 3rd year nursing students (n=310) who were enrolled in the 1st term of the academic year 2021/2022 who met inclusion criteria "having good and constant internet connection, having advanced mobile devices, approved to participate in the current research and are available during all phases of the research". - Their total number was 240 students distributed in twelve groups, 20students/group.

Tools for Data Collection

Four tools were used for data collection as follows;

Tool I: Knowledge Test about Blended PBL: A structured test was developed by the researchers after reviewing related literature; **Ismail, 2018, Nauri et al., 2019 and Alamri, 2021** to assess nursing students' knowledge about Blended-PBL. It included two parts as follows;

1st Part: **Subjects' personal characteristics**: It is concerned with personal data of the nursing students such as gender, place of residence, and previous technological training.

2nd Part: It consisted of two dimensions covering 36 questions in the form of multiple-choice questions as follows; Knowledge about blended learning "17 items" such as; Definition of Blended learning 2 items Importance of Blended learning 3 items, and Knowledge about PBL learning "19 items" such as; Definition of PBL learning 2 items, Technique of PBL 4 items, Role of the student during PBL 4 items.

Scoring System: The responses of students were given 1point for correct answer and 0 point for the incorrect answer. The score ranged from 0 to 36. The cut point was made at 60% = 22. The level of student's knowledge was considered to be "Good " if the percent ≥ 75% that equals 27 ≥ points," Fair" when the percent is from 60% to less than 75% that equals 22- <

27 points, and "Poor" if the percent < 60 % those equals < 22 points.

Tool II: Attitude toward Blended-PBL Questionnaire:

A structured self-reported questionnaire was developed by the researchers based on reviewing related literature**; Tang & Chaw, (2013), Birbal et al., and Arman, (2018)** to assess nursing students' attitudes toward Blended-PBL. It consisted of two dimensions as follows;

1st dimension: Attitude Toward Blended Learning consisted of six categories covering "36 items" as follows; Learning flexibility 4 items, Online learning 9 items, Study management 5 items, Technology 4 items, Classroom learning 5 items and Online interaction 9 items.

2nd dimension: Attitude Toward Problem-Based Learning consisted of four dimensions covering "25 items" as follows; Using computer and internet in education 7 items, Self-directed learning 7 items, Cooperative learning style 5 items, and Practical skills in electronics 6 items.

Scoring system: Students' answers were scored on five-points Likert scale ranging from 1-5, strongly disagree got 1 point, and strongly agree got 5 points. The score ranged from 61 to 305. The cut point was made at 60% = 183. Accordingly, students' attitude was considered "Positive" if the percent ≥ 75% equals ≥ 229 points, and "Negative " if the percent is less than 75%.

Tool III: Perceived Effectiveness of Blended-PBL Questionnaire:

A structured self-reported questionnaire was developed by the researchers based on reviewing related literature; **Varthis, 2016, Yuan et al., 2020, and Alamri, (2021)** to assess nursing students' perceived effectiveness of Blended PBL.

- It consisted of two dimensions as follows; **1st dimension: Perceived Effectiveness of Blended Learning** consisted of 18 items. **2nd dimension: Perceived Effectiveness of Problem-Based Learning** consisted of five key categories of problem-based learning including 25 items as follows; Construction of professional knowledge 5 items, Development of problem-solving skills 5 items, Development of self-directed learning 5 items, Improvement of motivation 5 items, and Promotion of effective group collaboration and participants 5 items.

Scoring system

Students' answers were scored on five points Likert Scale ranging from (1-5) one point for strongly disagree and 5 points for strongly agree. The score ranged from 43 to 215. The cut point was made at 60% = 129. Accordingly, students' perception level was considered "High" if the percent is ≥ 75% equals ≥ 162 points, "Moderate" from 60% to less than 75% that equals 129 - < 162 points, and "Low " if the percent < 60 % those equals < 129 points.

Tool IV: Creativity Measurement Questionnaire:

A structured self-reported questionnaire was developed by **Fields and Bischoff, (2014)** and modified by the researchers to assess nursing students' creativity levels. It included 12 dimensions covering 38 items namely; Challenging the status quo 5 items, Detachment 5 items, Synthesis 4 items, Cognition 3 items, Associate and Communicate 4 items, Awareness 3 items, Similarity 4 items, External motivation 3 items, Sensitivity 2 items, Experiment and Combine 2 items, Dimensional thinking 2 items and Problem-Solving 1 item.

Scoring system

Students' answers were scored on five points Likert Scale ranging from (1-5) one point for strongly disagree and 5 points for strongly agree. The score ranged from 38 to 190. The cut point was made at 60% = 114. Accordingly, students' creativity level was considered "High" if the percent ≥ 75% equals ≥ 143 points, "Moderate" from 60% to less than 75% equals

114 - < 143 points and "Low " if the percent < 60 % those equals < 114 points.

Tools validity and reliability

The four tools were reviewed by panel of five professors from nursing administration departments at Benha, Zagazig, Helwan, Menofia, and South Valley Universities. Necessary modifications were done according to their comments. The reliability of the tools was checked by Cronbach's Alpha coefficient test. Cronbach's alphas were as follows; **0.925, 0.785, 0.715, 0.721** for "Knowledge test about Blended PBL, Attitude toward Blended PBL Questionnaire, Perceived Effectiveness of Blended PBL Questionnaire and Creativity Measurement Questionnaire", respectively.

Ethical approval

The researchers got approval from the Scientific Research Ethics Committee, Faculty of Nursing, Benha University. Then official permission was obtained from the dean and then from the head of Nursing Administration department. An explanation about the purpose of the research had given to participants. Also, the researchers held meeting with students who were matching inclusion criteria, they were informed that all gathered data would be confidential, used only for scientific research, and they could quit the course at any time. Also, the researcher gave a brief description of the nature and methods that will be used in the course.

Pilot Study:

Before starting data collection, the revised tools' clarity, objectivity, and feasibility were tested in addition to estimating the time needed for filling them through a pilot study on 10% of the total number of students (24). No changes were needed, and subjects of the pilot study added within the total study subjects.

Field of Work:

- This research was carried out for 12 months from the start of July 2021 to the end of June 2022 throughout the following five phases;

Phase 1 "Preparatory phase"

This phase took about two months from the start of July 2021 to the start of Sept 2021 which included; reviewing national and international related literature, designing the four tools, examining their validity and reliability, having ethical approval and translating the tools into Arabic form, conducting pilot study, and then preparing the final copies of the four tools.

-Phase 2 "Assessment phase": Data collected during Sept 2021. This phase was designed to conduct an initial assessment of subjects' knowledge, attitude, and perceived effectiveness of Blended- PBL to be considered during the implementation of the course. In addition to assessing subjects' creativity levels to compare it with other phases of the course. The data was collected by sending electronic questionnaires via students' e-mails.

- Phase 3 "Planning phase": From the start of Oct 2021, Blended PBL course was planned to be applied as displayed in figure 1 where conventional components (lectures, and assignments) were blended with the following PBL steps; problem analysis, literature reviews, group work, problem-solving/ discussion, and reporting.
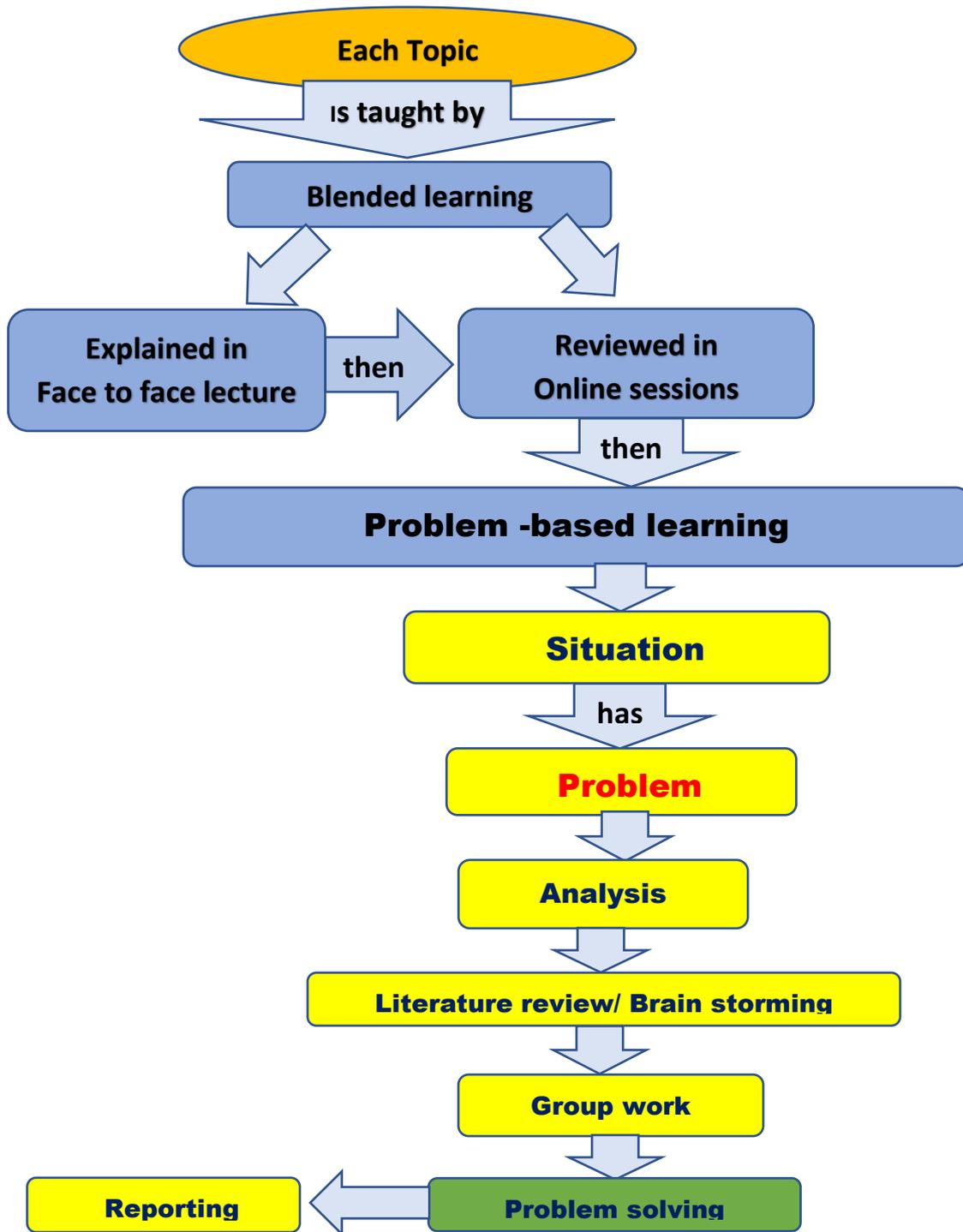
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Figure (1): Experimental procedure

- Designed classroom timetable was planned for teaching "Introduction to Principles of Nursing Administration Course" which involves 8 topics as follows; Management, Planning, Organizing, Staffing, Directing, Controlling, Problem-solving, and communication. Teaching materials included (videos, and handouts), time table for activities, training strategy, and problems situations were prepared.

-Phase 4 "Implementation phase": This phase took about two months covering the period from the mid of Oct 2021 to the mid of Dec 2021. The course lectures were implemented through (8) sessions per two months (one session for each topic/ week). It was implemented through two forms; **Firstly,** the "**Blended method**" which involves two methods of teaching; **traditional face-to-face** method which involves providing lectures at classrooms by dividing students into four groups (60 students/group) keeping safety precautions, masking, and social distancing. **Online method** was used for reviewing course lectures, discussions, and implementing Problem-based method.

- **Secondly, the "Problem-based method"** was implemented online also as follows;

- An orientation session was provided to help students familiarize themselves with the PBL method (as explained in Fig1).

-Interactive online environment was constructed through the use of the Microsoft Teams application that was chosen due to its interactive features, as it organizes content, engages, and connects students maintaining a collaborative learning place for teachers and students.

- Students were organized into small twelve groups (20 students /group) for online sessions; they were given a real-life scenario with a problem to work on it individually over the week. The researchers encouraged brainstorming on the given problem then they asked each group to summarize a solution to be presented and discussed in the online session at the end of the week.

-Virtual tools were employed to support the discussion of ideas leading to the production of a collaborative solution by the whole group. The group discussion experience took about 45 minutes.

-**Phase 5 "Evaluation phase"**: After implementation of Blended PBL, data were collected during the last two weeks of Dec 2021 by the same set of questionnaires to examine to what extent applying the course improved students' creativity levels and their knowledge, attitude, and perceived effectiveness regarding Blended PBL. After three months (April 2022), a follow-up study was done to evaluate the effect of the course using the same tools which were used before.

Statistical analysis

SPSS version 20 software computer package was used for data entering and analyzing. Descriptive statistics were applied (e.g., Frequency, Percentages, Mean, and Standard deviation). Paired T-test and Person Correlation, and Correlation coefficient (r) were used. Statistically, a significant difference was considered at p-value ≤0.05 and highly statistically significance when p≤0.005.

Results

Table 1 shows that the mean age of studied students was **21.23± 0.96**, and the highest percent of studied students were female, living in rural areas, and had attended previous technological training **(75%, 85% &71.7%)** respectively.

Table 2 shows that there was a highly statistically significant improvement in mean scores and standard deviation of students' total level of knowledge about Blended-PBL at immediately post-course implementation and follow-up phases as compared to the pre-course phase **(9.94±4.039, 8.80±3.068, 4.50±3.986)** respectively.

Figure 2 shows that the highest percent of students had a good level of knowledge about Blended-PBL at immediate post-course implementation and follow-up phase **(70%, 65%)** respectively.

Table 3 Illustrates that there was a highly statistically significant improvement in mean scores and standard deviation of students '

total attitude regarding Blended PBL at immediately post-course implementation and follow-up phases as compared to the pre-course phase (**241.63±37.01, 237.05±33.69**, **194.76± 33.85**), respectively.

Figure 3 clarifies that the highest percent of the students had a positive attitude toward Blended-PBL at immediate post-course implementation and follow-up phases **(85%, 70%),** respectively.

Table 4 reveals that there was a highly statistically significant improvement in mean scores and standard deviation of students' perceived effectiveness of Blended-PBL at immediately post-course implementation and follow-up phases as compared to the pre-course phase **(155.91±20.88, 155.98±20.77, 108.31±9.16)**

Figure 4 shows that the highest percent of students had a high level of perception regarding Blended-PBL effectiveness at

immediate post-course implementation and follow-up phase **(76.6%, 75%),** respectively.

Table 5 reveals that there was a highly statistically significant improvement in mean scores and standard deviation of students' total creativity at immediately post-implementation and follow-up phases as compared to the pre-course phase **(152.55±18.15, 141.72±20.40, 118.25±12.58),** respectively.

Figure 5 indicates that the highest percentage of students had a high level of creativity at immediate post-course implementation and follow-up phase **(70%, 67%),** respectively.

Table 6 indicates that there were highly statistically significant correlations among students' total level of knowledge, attitude, perceived effectiveness of Blended-PBL and their creativity levels at immediately post-course and follow-up phases **(r=.474 p=.000**, r=.367 p=.001**, r=0.970 p=.000**, r=.632 p=.000**, r=.673 p=0.000**)** respectively.

Table (1): Percent distribution of personal data of the study subject (n=240)

Personal data	No	%
Age		
21-	116	48.3
22-	96	40.0
>22	28	11.7
Mean± Sd	21.23± 0.96	
Sex		
Male	60	25.0
Female	180	75.0
Residence		
Urban	36	15.0
Rural	204	85.0
Previous technological training		
Yes	172	71.7
No	68	28.3

Table (2): Mean scores of study subjects' knowledge regarding Blended-PBL thorough the course phases (n=240)

Items	Max Scores	Course- phases			Paired t1	p value	Paired t2	P value	Paired t3	P-value
		Pre Mean ±SD	Immediate-Post Mean ±SD	Follow-Up Mean ±SD						
Knowledge about blended learning	17	2.083±2.316	4.86±2.103	4.333±1.910	13.004	.000**	7.662	.000**	1.941	.057
Knowledge about PBL	19	2.417±1.670	5.08±2.060	4.467±1.770	11.470	.000**	8.207	.000**	1.426	.159
Total knowledge about BPBL	36	4.50±3.986	9.94±4.039	8.800 ±3.68	15.586	.000**	11.128	.000**	1.762	.083

*Statistically significant (P ≤ 0.05)   * * Highly statistically significant (P ≤ 0.005)

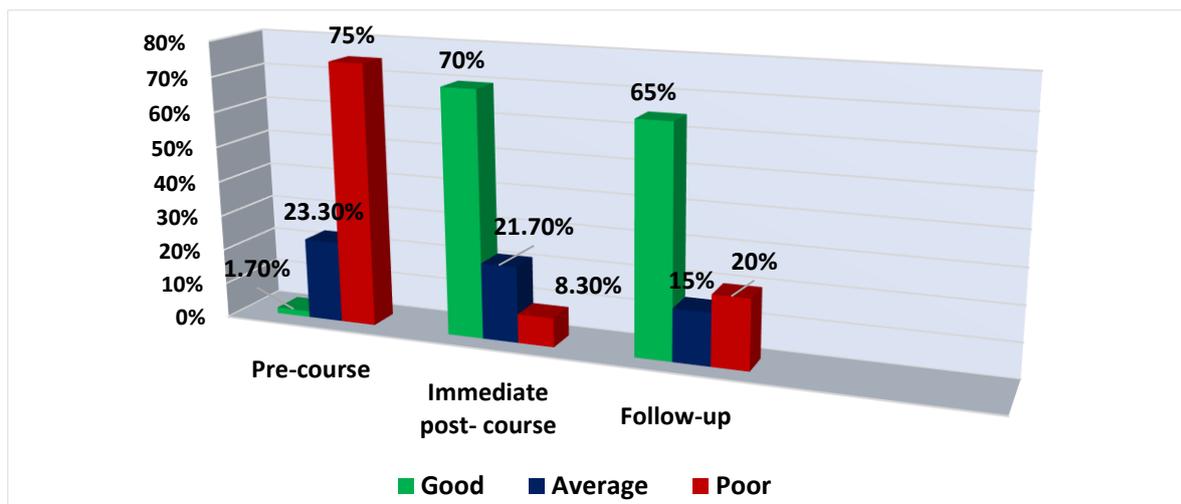   T-test 1: pre & post, t-test 2: pre & follow-up, t-test 3: post& follow-up

Figure (2): Total levels of students' knowledge regarding Blended-PBL thorough the course phases

Table (3): Mean-scores of students' attitudes toward Blended-PBL thorough course phases (n=240)

Items	Max Score	Course -phases			Paired t1	P-value	Paired t2	P-value	Paired t3	P-value
		Pre	Immediate Post	Follow-up						
		Mean ±SD	Mean± SD	Mean ±SD						
Attitude for blended learning	36	77.88±14.11	97.45±17.37	96.45±15.04	6.450	.000**	6.875	.000**	1.762	.083
Attitude for PBL	25	116.88±19.74	44.18±19.64	140.60±18.65	7.265	.000**	6.681	.000**	1.229	.224
Total attitude toward blended -PBL	61	194.76± 33.85	241.63±37.01	237.05±33.69	7.095	.000**	6.971	.000**	.872	.327

*Statistically significant (P ≤ 0.05)   * * Highly statistically significant (P ≤ 0.005)

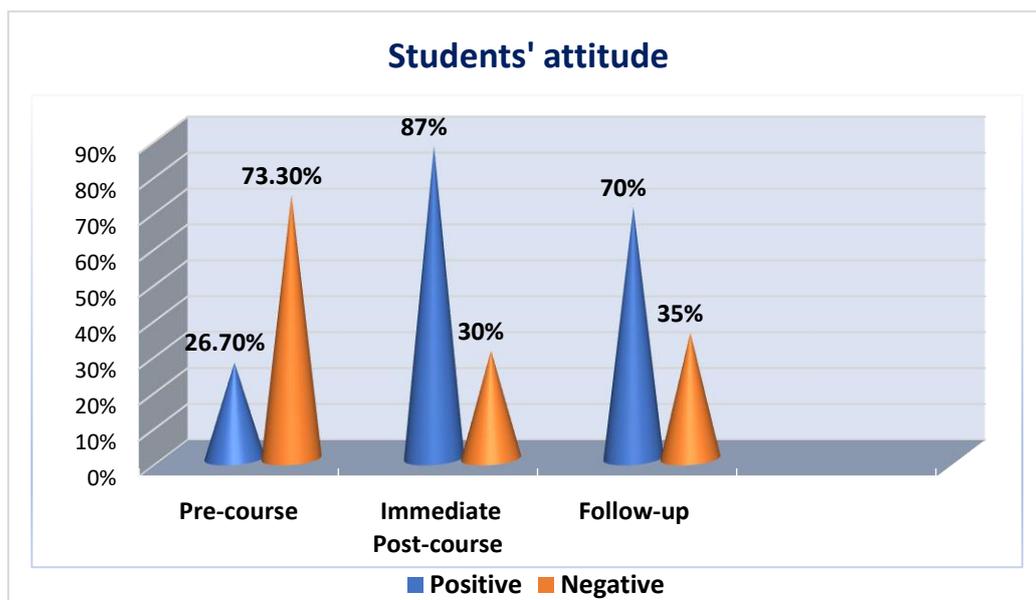t-test 1: pre & post, t-test 2: pre & follow-up, t-test 3: post& follow-up

Figure (3): Total levels of students' attitude toward Blended-PBL thorough course phases

Table (4): Mean scores of students' perceived effectiveness of Blended-PBL thorough course phases (n=240)

Dimensions	Max scores	Course- phases			Paired t-test1	p-value	Paired t-test1	p-value	Paired t-test3	p-value
		Pre	Immediate Post	Follow- up						
		Mean± SD	Mean± SD	Mean± SD						
Perceived effectiveness of blended learning	18	57.28±5.13	85.10±11.10	85.10±11.10	18.01	.000**	18.10	.000**	1.35	.18
Perceived effectiveness of PBL	25	51.03±4.03	70.81±9.78	70.88±9.67	14.47	.000**	14.67	.000**	1.13	.26
Total perceived effectiveness	43	108.31±9.16	155.91±20.88	155.98±20.77	19.144	.000**	14.67	.000**	.782	.437

*Statistically significant (P ≤ 0.05)   * * Highly statistically significant (P ≤ 0.005)
t-test 1: pre & post, t-test 2: pre & follow-up, t-test 3: post& follow-up
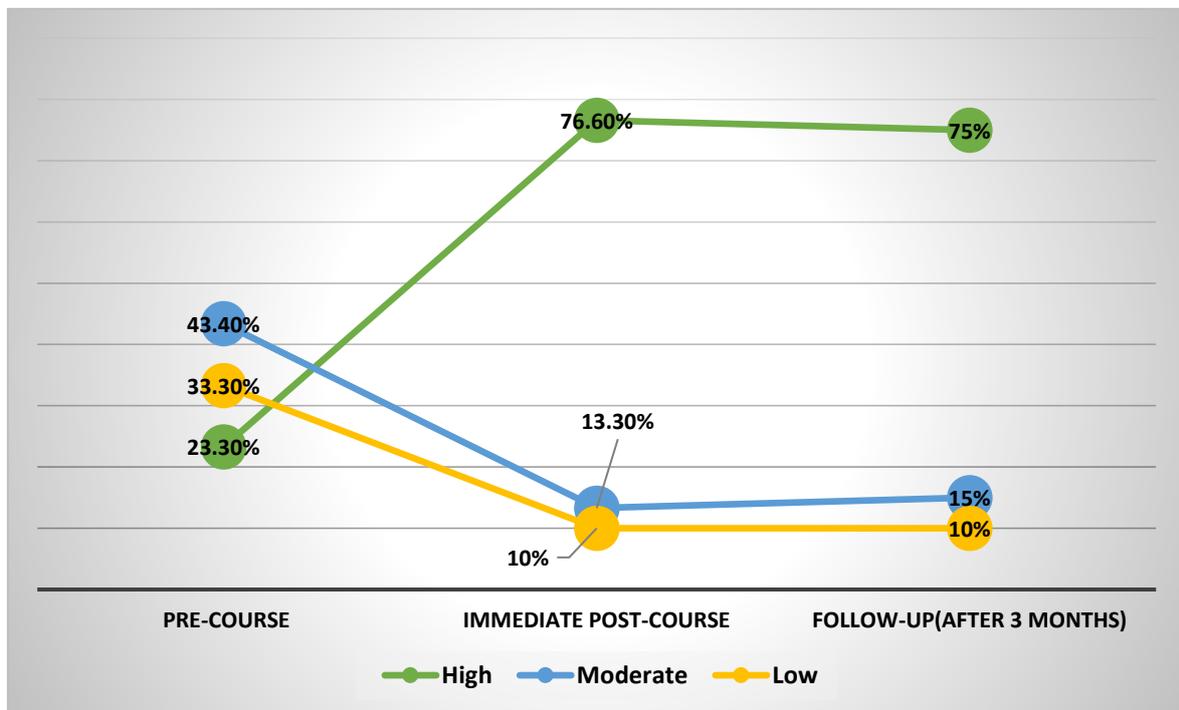

Figure (4): Total levels of students' perceived effectiveness regarding Blended PBL thorough course phases

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Table (5): Mean scores of the students' creativity thorough course phases (n=240)

Items	Max Score	Pre Mean ±SD	Immediate-Post Mean ±SD	Follow-up Mean ±SD	Paired t1	p-value	Paired t2	P-value	Paired t3	p-value
- Challenging the Status Quo	25	14.91±2.61	19.01±2.83	18.30±3.50	8.638	.000**	5.55	.000**	1.42	.15
- Detachment	25	16.80±4.17	18.56±3.75	18.58±3.54	4.292	.000**	0.76	.448	1.42	.15
- Synthesis	20	13.31±2.95	15.60±2.91	15.80±3.49	3.978	.000**	0.81	.419	1.42	.15
- Cognition	15	9.43±2.22	11.66±2.06	11.35±2.19	6.716	.000**	3.00	.004	1.42	.15
- Associate and communicate	20	12.10±3.28	17.25±2.19	17.11±2.66	10.216	.000**	4.80	.000**	1.42	.15
- Awareness	15	9.40±2.65	11.30±2.20	11.05±2.30	4.646	.000**	3.24	.002	1.35	.18
- Similarity	20	14.58±2.10	15.55±3.44	15.08±4.43	1.911	.061	5.25	.000**	1.76	.08
- External motivation	15	8.11±2.91	10.88±2.00	10.86±2.00	6.705	.000**	3.31	.002	1.76	.08
- Sensitivity	10	6.68±1.62	8.03±1.29	7.80±2.03	7.427	.000**	8.25	.000**	1.62	.10
- Experiment and combine	10	5.23±1.37	8.96±1.07	8.10±1.70	16.756	.000**	6.60	.000**	2.05	.04
- Dimensional Thinking	10	4.98±1.11	9.06±1.11	8.20±1.31	21.099	.000**	4.25	.000**	1.84	.07
- Problem-solving	5	2.72±0.94	4.65±0.48	3.85±1.05	14.188	.000**	6.06	.000**	2.05	.04
Total creativity	190	118.25±12.58	152.55±18.15	141.72±20.40	13.22	.000**	7.55	.000**	1.67	0.08

*Statistically significant (P ≤ 0.05)   * * Highly statistically significant (P ≤ 0.005)
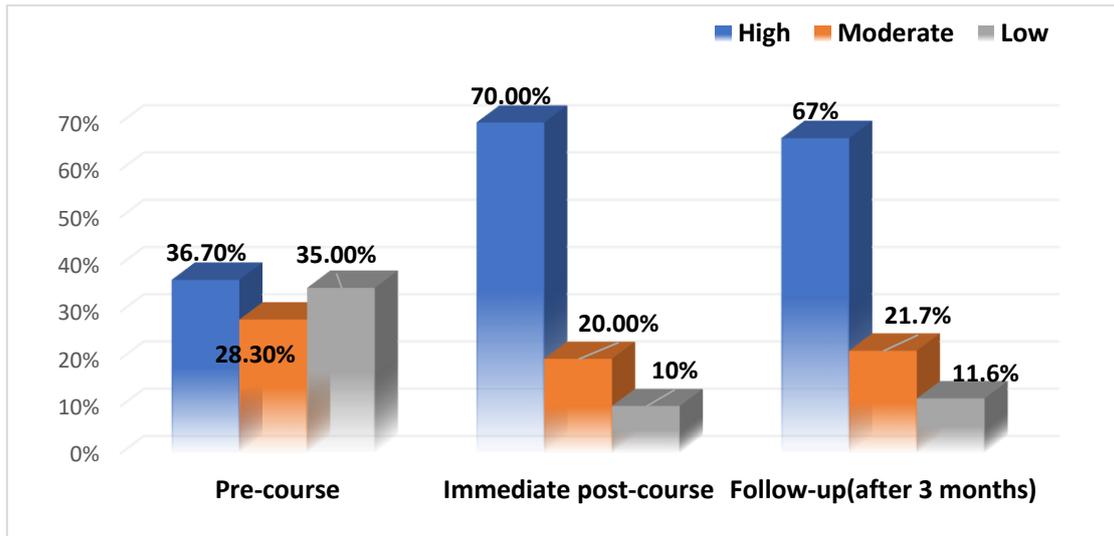t-test 1: pre & post, t-test 2: post & follow up, t-test 3: pre & follow up.

Figure (5): Total levels of students' creativity thorough the course phases

Table (6): Correlation between students' total Knowledge, Attitude, Perceived Effectiveness regarding Blended -PBL and Creativity after implementation of the course (n=240)

Variables	Creativity		
	Post -Course phases		
	Immediate -Post		Follow-up
Knowledge	r	.474	.367
	p-value	.000**	.001 **
Attitude	r	.970	.632
	p-value	.000**	0.000**
Perceived Effectiveness	r	.673	.557
	p-value	0.000**	0.000**

*Statistically significant (P ≤ 0.05) **Highly Statistically significant (P ≤ 0.005)

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Discussion

An integrated learning experience is now being stressed in the field of nursing education that enables students to apply knowledge creatively and solve problems in the clinical setting in an integrated manner **(Jung & Kong, 2017)**. As a result, nurses in high demand in the clinical setting are those who have creativity in applying knowledge, and solving issues creatively **(Cheraghi, et al., 2021)**.

The present study was designed to explore the effect of applying a Blended PBL course on nursing students' creativity levels. The researcher formulated the following hypothesis; "There would be a statistically significant difference between the mean scores of students' creativity levels on the pre, post and at follow up phases of applying Blended Problem-based learning ".

The result of the current study showed that the mean age of studied students was **21.23± 0.96**, and the highest percent of students were female, living in rural areas, and has attended previous technological training.

Firstly, concerning students' knowledge about Blended-PBL, the results of the current study revealed that there was a highly statistically significant improvement in students' total knowledge regarding Blended-PBL immediately after and at the follow-up phase of the course. This result can be interpreted as students acquiring their knowledge about Blended-PBL through their active participation in this learning experience. This interpretation is based on **Kolb's experiential learning theory (1984)**, which stated that knowledge is acquired through having experiences. And supported by **Kurt, (2021)** who stated that interacting with others, group work, and discussions help students to construct knowledge and understanding according to "Constructivist Learning Theory".

In the same line with the result of the current study, the result of the study that was conducted by **Car et al., (2019)** that indicated that Blended-PBL was more effective in improving knowledge. In addition to, **Supiandi and Julung, (2016)** stated that PBL has consistently improved students' cognitive learning outcomes because PBL promotes students how to apply their knowledge in real life situations.

Secondly, concerning students' attitude toward Blended-PBL, the results of the current study illustrated that there was a highly statistically significant improvement in students' total attitude toward Blended -PBL immediately after and at the follow-up phases. This result may be due to a combination of the two learning models which allow various learning methods (electronic, online, offline, face to face) that satisfy various learning styles of students, the virtual environment involves many forms of media and materials that stimulate students' interest in learning. In addition, learning through solving problems motivates students to engage in course activities, and encourages cooperation among them to find creative solutions.

This interpretation was supported by **Amin et al., (2021)** who stated that students' attitudes regarding BPBL are greatly affected by comfortable and flexible learning environment that improves student abilities in using mobile devices in learning which helps them to confidently perform the learning duties.

Additionally, **Tsai and Tang (2017)** they conducted an interview with students, they concluded that students were interested in using Blended-PBL. Also, students reported that Blended-PBL improved their ability to gain and use information, and became more confident in their learning skills.

The result of the current study is in the same line with, the results of the study that was performed by **Tsai and Tang, (2017)** showed that students demonstrated improvement in their attitudes following the implementation of the blended PBL course. Additionally, **Lukitasari**

et al., (2019), reported that students' attitudes towards the implementation of Blended-PBL were positive. Moreover, **Susilaningsih and Musyarofah (2020)** concluded that after following Blended-PBL, learners gain a positive attitude to the good and excellent levels.

Thirdly, regarding the perceived effectiveness of Blended-PBL, the current study findings indicated that there was a highly statistically significant improvement in students' total perception regarding Blended-PBL effectiveness immediately after and at follow-up phases of the course. This result may be interpreted as the actual use of blended PBL allows students to understand various features and advantages of it, and students find the whole experience easier and interesting that helps them to perceive how blended PBL inspires, motivates, engages, and encourages collaboration among them.

In agreement with this result, the study was done by **Dewi (2016)** revealed that providing PBL combined with blended learning improved students' positive perceptions. Also, **Alamri (2021)** found a significant relation between applying Blended- PBL and perceived usefulness.

By referring to the current study hypothesis which addresses the effect of applying blended PBL on students' total creativity levels, findings of the current study demonstrated that there was a highly statistically significant improvement in students' total creativity level immediately after implementation of the course and at follow-up phases. This result may be due to, students in Blended PBL course learned by solving problems, they situated in real-world problems, became active learners, worked collaboratively, experienced self-directed learning, and developed problem-solving skills, and engaged in critical thinking to create solutions that enhance creative thinking.

This interpretation was supported by **Zamroni., et al (2020)** they stated that

implementing Blended-PBL is effective for improving the critical thinking skills, maintaining higher order thinking and reflective learning. Especially, the ability to interpret, analyze, evaluate and inference the problems based on what is faced by students. And **Ülger, (2016)** stated that improving critical thinking skills of students has a positive effect on improving their creative thinking skills.

In accordance with the current result, the study that was conducted by **Nurkhin et al., (2020)** concluded that students have good creative thinking skills after implementing Blended-PBL. Also, **Nauri et al., (2019)** and **Tsai and Tang, (2017)** concluded that Blended-PBL enhanced students' creativity.

Moreover, **Lou et al., (2017)** concluded that after implementation of Stem PBL the students were encouraged to address problems more creatively. In addition to, **Khoiriyah and Husamah, (2018)** concluded that teachers can implement PBL to improve students' creative thinking skills

Regarding correlations among students' total levels of knowledge, attitude, and perceived effectiveness of Blended-PBL and their total creativity level, the current results illustrated that there were highly statistically significant correlations among these variables and students' total creativity levels immediately after and at follow-up phase.

Interpreting the correlation between students' total levels of knowledge about Blended- PBL and their total creativity levels, relies on the state that when students realized the improvement of their knowledge, they were motivated and inspired to collaborate with their colleagues to develop innovative and creative ideas to solve problems which eventually improve their creativity.

Considering the correlation with students' attitudes toward Blended- PBL, this result can be due to when individuals engage in tasks which they have adequate knowledge, interest, and positive attitude, they become

enthusiastic about it, this helps to improve their creative thinking.

This result can be supported by the study in **Bicer et al., (2019)**, who indicated that online PBL learning gained more positive attitudes among students engaged them in thinking and lead to improvement of their creative skills. While the result obtained by **Usta & Akkanat, (2015)** found a low positive relation between students' attitudes and their creativity.

Finally, **Addressing the correlation with perceived effectiveness of Blended-PBL**, this result may be due to, when students' perception about the effectiveness of Blended-PBL as a learning strategy increased, this increased their motivation and engagement in its activities which proved by many studies to have a high influence on improving students' creativity. This result is in the same line with **Alamri, (2021)** who concluded that the perceived usefulness of Blended- PBL enhances students' creative thinking.

Conclusions

Depending on the findings of the current study, we can conclude that Blended-PBL could be used to improve nursing students' creativity levels. In addition, it showed promising results in improving nursing students' total knowledge, attitude, and perceived effectiveness about Blended-PBL and it could be implemented for other nursing specialties in the future.

Recommendations:

Blended Problem-Based Learning should be gradually adopted as a new learning strategy for nursing students.
Nursing Educators should develop appropriate strategies for engaging students in Blended Problem-Based Learning courses.
Increasing nursing students ' awareness about Blended Problem-Based Learning through practical workshops.
Encouraging nursing students to participate in Blended Problem-Based Learning courses

Increasing teaching staff ' awareness about Blended Problem-Based Learning through various training workshops.
Nursing Educators should be prepared to apply Problem-Based Learning in various nursing courses.
Nursing Educators should be technologically trained to control online learning environment.
Further studies should be held to investigate the applicability of using Blended Problem-Based Learning on other nursing courses such as psychiatric and pediatric health nursing.
Limitations: Sometimes, there were interruptions during online lectures due to loss of internet and electricity.

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فاعلية تطبيق التعلم المدمج القائم على حل المشكلات على مستويات الإبداع لدى طلاب التمريض

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تأثر التعليم التمريضى بشكل كبير منذ حدوث الجائحة العالمية كوفيد 19،من أجل التعامل المناسب مع هذه الجائحة وكذلك تحديات القرن الواحد والعشرين الأخرى نحتاج ان يمتلك الخريج مهارة حل المشكلات بطريقة إبداعية.التعليم المدمج القائم على حل المشكلات يعتبرمثال للتعليم المبتكر الذى يتيح للطالب تعلم نشط ومرن كما انه يحسن مهارات الابداع وحل المشكلات لدى الطلاب لذا هدفت هذه الدراسة إلى استكشاف فاعلية تطبيق التعلم المدمج القائم على حل المشكلات على مستويات الإبداع لدى طلاب التمريض.وقد أجريت هذه الدراسة في كلية التمريض جامعة بنها. حيث اشتملت عينة الدراسة على عينة ملائمة من طلاب الفرقة الثالثة الذين التحقوا بالفصل الدراسي الأول من العام الدراسي 2021/2022. حيث يجب ان تتوافر بالعينة المعايير الاتية ؛ وجود اتصال دائم بالإنترنت وقبول المشاركة في الدراسة. وبلغ عددهم الإجمالي (240) طالب وطالبة . حيث أظهرت النتائج إلى وجود ارتباطات ذات دلالة إحصائية عالية بين المستوى الإجمالي للمعرفة لدى الطلاب ، والمواقف ، والفعالية المدركة ومستويات الإبداع لديهم في مراحل ما بعد التطبيق والمتابعة وقد أوصت الدراسة اعتمادًا على النتائج المستخلصة ، أنه يمكن استخدام التعلم المدمج القائم على حل المشكلات لتحسين مستويات الإبداع لدى طلاب التمريض. بالإضافة إلى ذلك ، يمكن تطبيقه في تخصصات التمريض الأخرى في المستقبل.