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Effectiveness of Simulation-Based Blood Pressure Measurement on Practice Competency among 2nd Year Nursing Students

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Abstract:
Background: *Clinical practice is fundamental component of the baccalaureate nursing program. It provides student nurses with knowledge, skills, and attitudes required for their future nursing roles. Blood pressure measurement is an important clinical nursing skill however, errors in measuring blood pressure occur often.* ***Aim:*** *to investigate the effect of using Simulation-Based Blood Pressure Measurement on Practice Competency among 2nd year nursing students at king abdulaziz university.* ***Design:*** *A quasi experimental research design was used.* ***Setting:*** *faculty of nursing, king abdulaziz university, Jeddah, - Kingdom Saudi Arabia.* ***Subjects:*** *convenience sample of 71 students were divided into 3 groups: A =24, B =24 and C= 23 students.* ***Tool:*** *Observation checklist of measuring blood pressure was adopted to measure the nursing student's practice/competency" in the three groups.* ***Results:*** *It revealed that in the first assessment, there was a statistical significant difference between group A (simulation by video) & B (demonstration method), also there was a statistical significant difference between A (simulation by video) & C (simulation by video & demonstration).* ***Conclusions:*** *During assessment II; it showed that demonstration was the best teaching method among the three groups. Demonstration during clinical placement is still considered the best method for teaching undergraduate nursing students.* ***Recommendations:*** *For perfect teaching blood pressure measurement; the use of demonstration & simulation by video method in combination. Simulation by video should not be used alone in teaching blood pressure measurement.*

Keywords: *Simulation Based- Blood pressure measurement- practice competency- Nursing Students.*

I. Introduction

Clinical practice requires critical thinking, problem solving abilities, specialized psychomotor & technological skills and professional value system **[1].** Health care professionals must use critical-thinking skills to solve increasingly complex problems. Educators need to help nurses develop their critical-thinking skills to maintain and enhance their competence [**2].**

Blood pressure measurement is considered by the osteopathic profession to be an established and accepted technique as part of the general health assessment of patients`. When combined with history taking and examination, blood pressure measurements help to determine the correct diagnosis treatment referral and management decision **[3].** Mastery of auscultatory blood pressure is challenging for preregistration nursing students. This phenomenon has been attributed to the psychomotor skills required, knowledge about blood pressure measurement, and the teaching modality type. Most studies focus on developing blood pressure proficiency without determining the measurement **[4].**

Error in blood pressure measurement may contribute to poor control of blood pressure. Underestimation of systolic blood pressure (SBP), or diastolic blood pressure (DBP), may have ramifications on the patient's immediate health, quality of life and financial status due to loss of work or hospitalization. Inadequately controlled blood pressure can result in cardiac, cerebral and vascular complications **[5].** The patient positioning during the measurement of blood pressure should be seated, with the lower arm extension and relaxation of the arm with the support pillow, and leaning back in his chair, legs uncrossed and feet flat on the floor, arm should be located at heart level, uncovered, supported with the palm facing up and elbow slightly flexed **[6,7].**

Accuracy education and training that develops healthcare professionals' clinical reasoning skills is emphasized as an important strategy to improve diagnostic performance and reduce overt diagnostic errors **[8].** Blood pressure (BP) measurement is an important clinical nursing skill **[9].** Measurement of a patient's blood pressure is one of the most common and basic medical assessments. However, errors in measuring blood pressure occur often **[10].** Errors in measuring blood pressure may have significant impact on the investigation and treatment of patients. Errors arise from faults in measurement technique or the equipment used **[5].**

A research of professionals in a hospital in North India revealed that in the technical aspect, only 2.2% of the professionals performed the correct technique of blood pressure measurement. When compared knowledge and technique, it was found that there was no correlation between them, being statistically

insignificant (p=0.94). Thus, professionals with good knowledge still performed the technique inappropriately **[11].** Nursing education encompasses the three domains of learning, the cognitive, the affective, and the psychomotor. One way to enhance nursing education is to evaluate the effectiveness of teaching methods in nursing education programs and implement the best methods. Assessment of teaching effectiveness in nurse preparation programs includes determining effective teaching skills, teachers' and students' beliefs about the teaching and learning process, criteria for assessing teaching effectiveness, people responsible for evaluating the various aspects of teaching, and other important elements for guiding the assessment of effective teaching in nursing education **[12].**

A simulation resembles reality. In specific reference to health care, simulation is an attempt to replicate some or nearly all of the essential aspects of a clinical situation so that the situation may be more readily understood and managed when it occurs for real in clinical practice **[13].** Simulation serves major strategic purposes. First, they give additional teaching time to students who cannot fully understand the course material through the classroom lectures and support materials such as the textbook. Second, simulation allows classroom coverage of more complex and challenging subject material that is more interesting to many students **[14].**

Virtual reality (VR) simulations are even newer innovations in which a computer /video display simulates the physical world, and user interactions are with the computer within that simulated (virtual) world. Existing technologies now allow for very high fidelity simulations, ranging from desktop computer-generated environments (much like those in 3-D computer games) to highly immersive VR "e.g., CAVE simulations where the user wears goggle and sensor-containing gloves and sits within a specially designed display" **[15].** Simulation is a technique, not a technology, to replace or amplify real experiences with guided experiences, often immersive in nature, that evoke or replicate substantial aspects of the real world in a fully interactive fashion **[16].**

Demonstration is a Visual Presentation or explanation of a fact, idea or process. Within Visual Arts there are a lot of hands on skills, which students need to learn. As humans, from an early age we learn hands on skills, by observing how someone else uses their skills. (A demonstration) Once we have been shown the skill we copy it and build upon it **[17].** Demonstrations are done to provide an opportunity to learn new exploration and visual learning tasks from a different perspective **[18].**

Demonstration may be used in the circumstance of proving conclusively a fact, as by reasoning or showing evidence **[19].** Advantages of demonstrations; utilize several senses; students can see, hear, and possibly experience an actual event. Stimulate interest; Present ideas and concepts more clearly. Provide direct experiences and reinforce learning **[20].** Even though there is not a common simulation framework, most simulations follow a similar design. There is usually some pre-work, or preparation learning, by the participant before the simulation. This is followed by the implementation of the simulation, which is subsequently followed by a debriefing session. Debriefings are generally conducted as a reflective learning experience in which participants review their performance in the simulation and the facilitator provides additional feedback **[21].**

There was a study by **[22]** who studied the standard of education at colleges and schools of pharmacy. He reported that these standards of education are challenged with preparing students to perform appropriate intervention activities, such as blood pressure monitoring, patient counseling on anti-hypertensive medications, and pharmaco-therapeutic recommendations for the management of hypertension. The standard of education at this point has been to provide structured didactic lectures, patient case scenarios, problem-based learning (PBL) techniques, and clinical assessment laboratories to teach the fundamentals of blood pressure assessment and management of hypertension.

Competence is defined as a generic quality referring to a person's overall capacity and competency refers to specific capabilities such as leadership, which are made up of knowledge, attitudes and skills. While performance is concerned with demonstrated ability to do something; consensus is lacking as whether this demonstrates competence and whether performance is required to demonstrate competence **[23].** The strategy for assessing competency is the responsibility of educational institutions that are providers of nursing education. Although there are numerous tools available to measure clinical competency, a comprehensive and effective measure of clinical competency has not been established **[24].**

Significance of the study:

Under the influence of the evolution of educational methodologies, skills training and construction of specific knowledge, learning of blood pressure checking technique is a constant concern in the nursing teaching scenario, due to its presence in the daily routine of professional **[25, 26].** One of the required nursing subjects is fundamental of nursing, a very important foundation subject, which aims to teach many clinical skills to the students. In order to prepare them for authentic setting, nursing educators should identify teaching methods which are the most appropriate for nursing students to enhance and apply the knowledge to practice appropriately **[12].**

A study conducted by **[22]** who pointed out that, pharmacy students showed significant improvement in clinical practice and in their knowledge of the pharmacotherapy of hypertension. Students expressed high levels of satisfaction with this type of learning experience. While **[5]** mentioned that the findings indicate that knowledge of participants was inadequate to perform blood pressure measurement in a standardized manner, and prevent introduced error.

Simulation experience or laboratory is an ideal setting for students to develop psychomotor skills without risk of inflicting harm to patients. Becoming comfortable and competent with technology; simulation has become more integrated into the education of nurses and physicians in the past 20 years, but is not fully integrated into the development of skills for practicing nurses. Despite recommendations for use of simulation, and growing integration of simulation into education, empirical evidence for the impact of simulation on patient outcomes is still underdeveloped **[27].** A study by **[21]** provided an overview of simulation techniques and uses; discuss current uses of simulation by practicing nurses; and recommend strategies to develop a simulation program. In Egypt; Graduate nurses must be critical thinkers with the ability to manage complex situations, and it is expected that nursing education will be help students to develop their critical thinking dispositions. Nurse educators are therefore encouraged to evaluate courses and teaching strategies to ascertain whether critical thinking is reflected in their curricula **[28].**

Aim of the Study

The aim of this study was to investigate the effectiveness of simulation-based blood pressure measurement on practice competency among 2nd year nursing students at King Abdulaziz University.

Hypothesis:

1. Using combination of teaching methods for blood pressure measurement may have an effect on improving practice competency than using only one teaching method among nursing students.
2. The blood pressure measurement acquired practice will be improved after 3 months' period than before among nursing students.

II. Subjects and Method

Research design: A quasi experimental research design was utilized in this study to investigate the effect of using different teaching methods for blood pressure measurement.

Setting: Faculty of Nursing, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia (KSA). The educational system at faculty of Nursing, King Abdulaziz University, Jeddah, KSA used to begin with one preparatory year in which the student used to have a general course in physics, chemistry, biology and English language. As regard nursing field used to begin the foundations of nursing at the second university year.

Subjects: A convenience sample of 71 students (all the 2nd year nursing students who agree to participate in the study and fulfilling the following inclusion criteria**:**

- Second year nursing students.
- All subjects had not been trained previously in the measurement of BP using human patient simulators.

They are divided into 3 groups:

- **Group (A):** This group included 24 students who acquired skills of measuring blood pressure through Simulation by video **[29].**
- **Group (B):** This group included 24 students who acquired skills of measuring blood pressure through demonstration method.
- **Group (C):** This group included 23 students who acquired skills of measuring blood pressure by using the two previous methods (simulation by video & demonstration).

Tool of the study:

- Observation checklist of measuring blood pressure was adopted from **Berman, et al., (2008), [30]** to measure the nursing student's practice" competency" in the three groups.

Scoring System of Study Tool:

The observation checklist consisted of 16 items, regarding nurses` practice competency as regard blood pressure measurement:

- Done = 2
- Not done=1

Procedure for Data collection:

- The present study was carried out within four months started from the 1st of February to the end of May 2015**.**
- Approval: Before data collection the necessary approval was secured from the ethical committee of faculty of nursing, King Abdulaziz University, Jeddah, Kingdom Saudi Arabia (KSA). The purpose of the study was explained to nursing student and verbal agreement was taken to participate in the research was taken.
- **Ethical consideration and Informed consent:**
  During the initial interview, the purpose of the study and the procedures were explained to nursing student. Student's verbal consent to conduct the study was taken. They were assured that all information would be confidential to assure the confidentiality. Subjects were assured that their participation in the study was voluntary and that they could withdraw from the study at any time and can refuse to participate in the study.
- **Validity of tools:** A jury of seven experts reviewed the tools from academic staff from the medical surgical nursing, faculty of nursing, King Abdulaziz University. They were selected to test the clarity, feasibility and relevance of tools. The corrections were done accordingly based on their response.
- **Reliability of the tool**: The reliability co-efficient regarding the observational checklist about blood pressure measurement, the researcher repeated the reliability co-efficient; the Cronbach's alpha of the tool was showed 0 .798. Hence the study tools indicate good reliability for conducting the research study.
- **Pilot study**: A pilot study was carried out on 10% of the subjects. Tools were tested in the previously mentioned setting in order to be revised for clarity, understanding, comprehensiveness, practicability, applicability, feasibility and ease of implementation, detecting obstacles and problems that may be encountered during data collection. It also helped to estimate the time needed to fill in the study tools. Data collected from the pilot study were analyzed. The researcher has excluded the piloted data from the sample size participating in the study.
- The study maneuver comprised 2 main phases, namely implementation phase and assessment phase.
- **Implementation phase**:
  - Simulation by video of blood pressure measurement was used as method of teaching in group A, followed by assessment through re-practicing of each student.
  - Demonstration of blood pressure measurement was done in front of the students by clinical instructor for group B followed by assessment through repracticing of each student.
  - Simulation by video followed by demonstration of blood pressure measurement were used together as a method of teaching for group C followed by assessment through repracticing of each student.
- **Assessment phase:** To determine the appropriate teaching method of blood pressure measurement, each student during practice of blood pressure measurement was assessed twicely.
  - First assessment was done immediately after using different methods of teaching for each group.
  - Second assessment was done after three months from the first assessment using the same observation checklist.
- The data was collected by the researchers themselves through observing the nursing students for collection of data.
- The time required to complete the assessment tool was about 20 -25minutes.
- **Limitation:** During the second assessment group C number decreased to 20 students due to turnover of the nursing students.

Statistical analysis:

The data has been analyzed using SPSS version 16. SPSS is a comprehensive system for analyzing data. SPSS can take data from almost any type of file and use them to generate tabulated reports, charts, and plots of distributions and trends, descriptive statistics, and complex statistical analysis. Data was represented as frequencies, percentages, and mean ± standard deviation, chi square, p for Monte Carlo test, P; value of McNemar test, F test and t: paired t-test were used.

III. Results

- The students were all females, their ages ranged between 19-22 years old.

Table (1) showed distribution of the student's blood pressure procedure steps according to the three methods of teaching in assessment I. It reveals that none of students had done step of explaining the procedure in group A, while 41.7%& 95.7% did not do step of explaining the procedure in group B & group C respectively with statistical significant difference (MCp<0.001). Also there was statistical significant difference among students in the step of applying center of cuff bladder directly over the brachial artery (p<0.001). On the other hand, difference was significant in the other two steps No.8 & No. 9 P=0.002 & 0.003 respectively.

Table (2) showed distribution of student's blood pressure procedure according to the three methods of teaching in assessment II. It shows that group B 91.7% of students had done step of "the elbow should be slightly flexed with the palm of the hand facing up and forearms supported at the heart level" during assessment II while 58.3% did it in group A and only 35% of group C with a statistical significant difference among the three groups (P<0.01). The difference was also significant in steps No. 5 & 6 MCp <0.001 &=0.001 consecutively. As regard step of "palpating brachial artery or radial artery with fingers" of the students 75%, 37.5% &20% of group B , A & C had done it with statistical difference was significant (χ^2=14.282). In relation to step No. 11 41.7% , 70.8% & 20% of the students in group A, B & C had done it with statistical difference was significant among them (χ^2=11.594).

Table (3) showed comparison between assessment I and II of student's practice/competency in measuring blood pressure after using Simulation by video method. 45.8% of the students had done the step of explaining the procedure to client in assessment II while none of them in assessment I and the difference was significant (p=0.001). The difference was significant between assessment I and assessment II (p=0.022) in relation to "wrapping the cuff around the arm above the elbow cress 2 fingers". As regards to step No. 9; 29.2% in assessment I increased to 33.3% during assessment II, the difference was not significant. In relation to step No. 14; it was 29.2% during assessment I decreased to 8.3% in assessment II, the difference was not significant p=0.180.

Table (4) showed comparison between assessment I and II of students' practice/competency in measuring blood pressure after using demonstration. During assessment I; 29.2% of the students provided privacy while it had been increased to 41.7% in assessment II but the difference was not significant (p=0.549). As regards to step No. 7; there was significant difference between assessment I & II (p=0.001). On the other hand, 66.7% of the subjects were palpating brachial artery or radial artery with finger in assessment I and increased to 75% during assessment II but the difference was not significant. 29.2% of the students were documenting blood pressure reading on graphic sheet in the first assessment. It had been decreased to 12.5% in assessment II and the difference was not significant (p=0.289).

Table (5) showed comparison between assessment I and II of students' /practice/competency in measuring blood pressure after using Simulation by video and demonstration method. In assessment I; only 4.3% explained the procedure to the patients, and increased to 55% during assessment II with statistical significant difference (p=0.002). On the other hand, 60.9% wrap the cuff around the arm above the elbow cress 2.5 cm. This is decreased to 10% in assessment II with statistical difference was significant (p=0.001). The difference was significant in the following steps No. (7 & 8) p=0.012 & <0.001 consecutively between assessment I and II. On contrast, there was 26.1% in assessment I decreased to 5% in assessment II during the step No. 14 the difference was not significant (p=0.125).

Table (6) showed comparison among the three types of teaching methods of measuring blood pressure in assessment I and assessment II. In assessment I; there was a significant difference between the three methods (p_1=0.002) in demonstration method and p_1=0.001 in demonstration and simulation by video method. Also the difference was significant (P<0.001) in demonstration method during assessment II.

Table (1): Distribution of the Student's Blood Pressure Procedure Steps According to the Three Methods of Teaching Assessment I

Blood Pressure Procedure Steps	Types						Test of sig.
	Simulation by video (group A)		Demonstration (group B)		Simulation by video and Demonstration (Group C)		
	No.	%	No.	%	No.	%	
1-Explain procedure to client							
Done	0	0.0	14	58.3	1	4.3	MCp <0.001*
Not done	24	100.0	10	41.7	22	95.7	
2-Wash hand							
Done	2	8.3	6	25.0	6	26.1	□□□=2.977
Not done	22	91.7	18	75.0	17	73.9	p = 0.226
3-Provide privacy							
Done	3	12.5	7	29.2	6	26.1	□□□= 2.155
Not done	21	87.5	17	70.8	17	73.9	p = 0.340
4-The elbow should be slightly flexed with the palm of the hand facing up and forearm supported at heart level							
Done	15	62.5	22	91.7	17	73.9	□□□= 5.692
Not done	9	37.5	2	8.3	6	26.1	p = 0.058
5-Wrap the cuff around the arm above the elbow cress 2.5 (2 finger)							
Done	12	50.0	19	79.2	14	60.9	□□□= 4.491
Not done	12	50.0	5	20.8	9	39.7	p = 0.106
6-Apply the center of cuff bladder directly over the brachial artery							
Done	10	41.7	15	62.5	22	95.7	□□□= 15.518*
Not done	14	58.3	9	37.5	1	4.3	p <0.001
7-Arrange the manometer at the edge level to prevent error reading							
Done	16	66.7	20	83.3	20	87.0	MCp = 0.266
Not done	5	33.3	4	16.7	3	13.0	
8-Palpate brachial artery or radial artery with fingers							
Done	10	41.7	16	66.7	21	91.3	□□□= 12.936*
Not done	14	58.3	8	33.3	2	8.7	p = 0.002
9-Close the valve on the cuff to inflate until the pulse disappears. Determine the reading (systolic pressure)							
Done	7	29.2	14	58.3	18	78.3	□□=11.604*
Not done	17	70.8	10	41.7	5	21.7	p = 0.003
10-Deflate the cuff completely and wait for 1 to 2 minutes. Then inflate the cuff above the previous reading 30mm Hg							
Done	5	20.8	9	37.5	8	34.8	□□□= 1.788
Not done	19	79.2	15	62.5	15	65.2	p = 0.409
11-Position the bell or diaphragm of stethoscope over the brachial artery that palpated before							
Done	16	66.7	15	62.5	17	73.9	□□□= 0.713
Not done	8	33.3	9	37.5	6	26.1	p = 0.700
12-Release the valve slowly 2 to3 mmHg/sec							
Done	6	25.0	5	20.8	11	47.8	□□□= 4.609
Not done	18	75.0	19	79.2	12	52.2	p = 0.100
13-Note the sound change and determine when the systole and diastole (first and disappear sound)							
Done	4	16.7	7	29.2	10	43.5	□□□= 4.056
Not done	20	83.3	17	70.8	13	56.5	p = 0.132
14-Unsure reading completely deflates the cuff wait 1to 2 min. then re-inflate again							
Done	7	29.2	7	29.2	6	26.1	□□□= 0.070
Not done	17	70.8	17	70.8	17	73.9	p = 0.964
15-Document the B.P reading on graphic sheet							
Done	2	8.3	7	29.2	4	17.4	MCp = 0.172
Not done	22	91.7	17	70.8	19	82.6	
16- Return the equipment							
Done	3	12.5	7	29.2	4	17.4	MCp = 0.367
Not done	21	87.5	17	70.8	19	82.6	

χ^2: Chi square test MCp: p for Monte Carlo test *: Statistically significant at $p \leq 0.05$

Table (2): Distribution of Student's Blood Pressure Procedure Steps according to the three methods of teaching in assessment II

Blood Pressure Procedure Steps	Types						Test of sig.
	Simulation by video (group A)		Demonstration (group B)		Simulation by video and Demonstration (Group C)		
	No.	%	No.	%	No.	%	
1-Explain procedure to client							
Done	11	45.8	12	50.0	11	55.0	□□□= 0.367
Not done	13	54.2	12	50.0	9	45.0	p = 0.832
2-Wash hand							
Done	4	16.7	3	12.5	5	25.0	MCp = 0.625
Not done	20	83.3	21	87.5	15	75.0	
3-Provide privacy							
Done	3	12.5	10	41.7	5	25.0	□□□=5.267
Not done	21	87.5	14	58.3	15	75.0	p = 0.071
4-The elbow should be slightly flexed with the palm of the hand facing up and forearm supported at heart level							
Done	14	58.3	22	91.7	7	35.0	□□□=15.451*
Not done	10	41.7	2	8.3	13	65.0	p <0.001
5-Wrap the cuff around the arm above the elbow cress 2.5 (2 finger)							
Done	3	12.5	18	75.0	2	10.0	MCp <0.001*
Not done	21	87.5	6	25.0	18	90.0	
6-Apply the center of cuff bladder directly over the brachial artery							
Done	13	54.2	20	83.3	4	20.0	MCp = 0.001*
Not done	11	45.8	4	19.4	16	80.0	
7-Arrange the manometer at the edge level to prevent error reading							
Done	19	79.2	9	37.5	9	45.0	□□□=9.411*
Not done	5	20.8	15	62.5	11	55.5	p = 0.009
8-Palpate brachial artery or radial artery with fingers							
Done	9	37.5	18	75.0	4	20.0	□□□=14.282*
Not done	15	62.5	6	25.0	16	80.0	p = 0.001
9-Close the valve on the cuff to inflate until the pulse disappears. Determine the reading (systolic blood pressure)							
Done	8	33.3	19	79.2	11	55.0	□□□=10.234*
Not done	16	66.7	5	20.8	9	45.0	p = 0.006
10-Deflate the cuff completely and wait for 1 to 2 minutes. Then inflate the cuff above the previous reading 30mm Hg							
Done	2	8.3	10	41.7	2	10.0	MCp = 0.015*
Not done	22	97.1	14	58.3	18	90.0	
11-Position the bell or diaphragm of stethoscope over the brachial artery that palpated before							
Done	10	41.7	17	70.8	4	20.0	χ^2=11.594*
Not done	14	58.3	7	29.2	16	80.0	p = 0.003
12-Release the valve slowly 2 to3 mmHg/sec							
Done	6	25.0	5	20.8	3	15.0	χ^2 = 0.669
Not done	18	75.0	19	97.2	17	85.0	p = 0.716
13-Note the sound change and determine when the systole and diastole (first and disappear sound)							
Done	4	16.7	5	20.8	1	5.0	MCp = 0.388
Not done	20	83.3	19	79.2	19	95.0	
14-Unsure reading completely deflates the cuff wait 1to 2 min. then re-inflate again							
Done	2	8.3	6	25.0	1	5.0	MCp = 0.134
Not done	22	91.7	18	75.0	19	95.0	
15-Document the B.P reading on graphic sheet							
Done	3	12.5	3	12.5	12	60.0	MCp = 0.001*
Not done	21	87.5	21	87.5	8	40.0	
16- Return the equipment							
Done	0	0.0	7	29.2	12	60.0	□□□= 19.533*
Not done	24	100.0	17	70.8	8	40.0	p <0.001

χ^2: Chi square test MCp: p for Monte Carlo test *: Statistically significant at $p \leq 0.05$

Table (3): Comparison between assessment I and II of student's practice/competency of measuring blood pressure after using Simulation by video method

Blood Pressure procedure Steps	Simulation by video				p
	Assessment I		Assessment II		
	No.	%	No.	%	
1-Explain procedure to client	0	0.0	11	45.8	0.001*
2-Wash hand	2	8.3	4	16.7	0.625
3-Provide privacy	3	12.5	3	12.5	1.000
4-The elbow should be slightly flexed with the palm of the hand facing up and forearm supported at heart level	15	62.5	14	58.3	1.000
5-Wrap the cuff around the arm above the elbow cress 2.5 (2 finger)	12	50.0	3	12.5	0.022*
6-Apply the center of cuff bladder directly over the brachial artery	10	41.7	11	45.8	0.607
7-Arrange the manometer at the edge level to prevent error reading	16	66.7	19	79.2	0.549
8-Palpate brachial artery or radial artery with fingers	10	41.7	9	37.5	1.000
9-Close the valve on the cuff to inflate until the pulse disappears. Determine the reading (systolic pressure)	7	29.2	8	33.3	1.000
10-Deflate the cuff completely and wait for 1 to 2 minutes. Then inflate the cuff above the previous reading 30mm Hg	5	20.8	2	8.3	0.375
11-Position the bell or diaphragm of stethoscope over the brachial artery that palpated before	16	66.7	10	41.7	0.070
12-Release the valve slowly 2 to3 mmHg/sec	6	25.0	6	25.0	1.000
13-Note the sound change and determine when the systole and diastole (first and disappear sound)	4	16.7	4	16.7	1.000
14-Unsure reading completely deflates the cuff wait 1to 2 min. then re-inflate again	7	29.2	2	8.3	0.180
15-Document the B.P reading on graphic sheet	2	8.3	3	12.5	1.000
16-Return the equipment	3	12.5	0	0.0	0.083

P: value of McNemar test

*: Statistically significant at $p \leq 0.05$

Table (4): Comparison between assessment I and II of student's practice/competency of measuring blood pressure after using demonstration method

Steps of the blood pressure procedure	Demonstration				p
	Assessment I		Assessment II		
	No.	%	No.	%	
1-Explain procedure to client	14	58.3	12	50.0	0.804
2-Wash hand	6	25.0	3	12.5	0.375
3-Provide privacy	7	29.2	10	41.7	0.549
4-The elbow should be slightly flexed with the palm of the hand facing up and forearm supported at heart level	22	91.7	22	91.7	1.000
5-Wrap the cuff around the arm above the elbow cress 2.5 (2 finger)	19	79.2	18	75.0	1.000
6-Apply the center of cuff bladder directly over the brachial artery	15	62.5	4	16.7	0.227
7-Arrange the manometer at the edge level to prevent error reading	20	83.3	9	37.5	0.001*
8-Palpate brachial artery or radial artery with fingers	16	66.7	18	75.0	0.754
9-Close the valve on the cuff to inflate until the pulse disappears. Determine the reading (systolic pressure)	14	58.3	19	79.2	0.180
10-Deflate the cuff completely and wait for 1 to 2 minutes. Then inflate the cuff above the previous reading 30mm Hg	9	37.5	10	41.7	1.000
11-Position the bell or diaphragm of stethoscope over the brachial artery that palpated before	15	62.5	17	70.8	0.727
12-Release the valve slowly 2 to3 mmHg/sec	5	20.8	5	20.8	1.000
13-Note the sound change and determine when the systole and diastole (first and disappear sound)	7	29.2	5	20.8	0.727
14-Unsure reading completely deflates the cuff wait 1to 2 min. then re-inflate again	7	29.2	6	25.0	1.000
15-Document the B.P reading on graphic sheet	7	29.2	3	12.5	0.289
16-Return the equipment	7	29.2	7	29.2	1.000

P: value of McNemar test

*: Statistically significant at $p \leq 0.05$

Table (5): Comparison between assessment I and II of student's practice/competency in measuring blood pressure after using Simulation by video and demonstration

Steps of the blood pressure procedure	Simulation by video and Demonstration				p
	Assessment I		Assessment II		
	No.	%	No.	%	
1-Explain procedure to client	1	4.3	11	55.0	0.002*
2-Wash hand	6	26.1	5	25.0	1.000
3-Provide privacy	6	26.1	5	25.0	1.000
4-The elbow should be slightly flexed with the palm of the hand facing up and forearm supported at heart level	17	73.9	7	35.0	0.092
5-Wrap the cuff around the arm above the elbow cress 2.5 (2 finger)	14	60.9	2	10.0	0.001*
6-Apply the center of bladder directly over the brachial artery	22	95.7	16	80.0	0.706
7-Arrange the manometer at the edge level to prevent error reading	20	87.0	9	45.0	0.012*
8-Palpate brachial artery or radial artery with fingers	21	91.3	4	20.0	<0.001*
9-Close the valve on the cuff to inflate until the pulse disappears. Determine the reading (systolic pressure)	18	78.3	11	55.0	0.070
10-Deflate the cuff completely and wait for 1 to 2 minutes. Then inflate the cuff above the previous reading 30mm Hg	8	34.8	2	10.0	0.125
11-Position the bell or diaphragm of stethoscope over the brachial artery that palpated before	17	73.9	4	20.0	0.001*
12-Release the valve slowly 2 to3 mmHg/sec	11	47.8	3	15.0	0.070
13-Note the sound change and determine when the systole and diastole (first and disappear sound)	10	43.5	1	5.0	0.088*
14-Unsure reading completely deflates the cuff wait 1to 2 min. then re-inflate again	6	26.1	1	5.0	0.125
15-Document the B.P reading on graphic sheet	4	17.4	12	60.0	0.002*
16-Return the equipment	4	17.4	12	60.0	0.003*

P: value of McNemar test
*: Statistically significant at $p \leq 0.05$

Table (6): Comparison between the three types of teaching methods of measuring blood pressure in assessment I and assessment II

Assessment phase	Simulation by video (group A)	Demonstration (group B)	Simulation by video and Demonstration (Group C)	Test of sig.
Assessment I Range Mean ± SD	0.0 – 11.0 4.92 ± 3.51	3.0 – 14.0 7.92 ± 3.35	3.0 – 12.0 8.04 ± 2.46	F = 7.517* p = 0.001
p_1		**0.002***	**0.001***	
p_2			**0.891**	
Assessment II Range Mean ± SD	0.0 – 8.0 4.63 ± 1.95	2.0 – 13.0 7.67 ± 2.78	0.0 – 10.0 4.65 ± 2.89	F = 10.944* p <0.001
p_1		**<0.001***	**0.974**	
p_2			**<0.001***	
t (p)	**0.349 (0.730)**	**0.343 (0.734)**	**4.421* (<0.001)**	

F: F test (ANOVA) between the three types of check list
p_1: p value of LSD test between simulation by video and other types
p_2: p value of LSD test between demonstration with demonstration & simulation by video
t: Paired t-test between assessment I and assessment II in each type of check list
***:** Statistically significant at $p \leq 0.05$

IV. Discussion

Blood pressure measurement is an essential clinical skill for the beginning years of nursing to master. Teaching blood pressure measurement involves tuition in both psychomotor skills and theoretical knowledge. Research suggests that lack of suitable clinical placements and quality supervision have an impact on nursing students' experiences and skill development for blood pressure measurement **[9].** Preparation in a laboratory setting, as well as supervised practice of blood pressure measurement, is considered beneficial in ensuring students gain confidence in connecting theory to practice **[31].** The aim of this study was to investigate the effectiveness of simulation-based blood pressure measurement on practice competency among 2nd year nursing students at King Abdulaziz University.

The findings of the present study showed that there was no statistical significant difference among the three groups" A, B, & C" who are exposed to different teaching methods of blood pressure measurements (Table 1). This is parallel with **[32]** who studied "Nursing students' blood pressure measurement following CD-ROM and conventional classroom instruction: a pilot study" and mentioned that all of Group B "group of conventional instructions" failed to position the stethoscope correctly therefore with no statistical significant difference P = 0.700 while the CD- ROM only group "A" did significantly better in the positioning of the stethoscope may be due to the extra reinforcement provided by the CD-ROM which illustrated this aspect of the procedure using close up simulation by video sequences and diagrams. The correct positioning of the stethoscope was also reinforced through the CD-ROM post-test which students were required to complete; the reinforcement opportunities were not available to group B" group of conventional instructions". Also a cross-sectional study was conducted in Rio Grande do Sul Cardiology Institute, Brazil, with 110 surveyed people, 42.1% were failed at detecting location of the brachial artery by palpation **[6, 33].** As for the location of the brachial artery by palpation, the palpation of the brachial artery should perform in the cubital fossa before placing the bell or stethoscope diaphragm, which was not carried out by the participants **[6].**

The present study results revealed that most of the procedure steps in assessment II showed that a statistical significance difference among the three methods of teaching on the other hand it showed that there was no statistical significant difference in the following six steps which were; explaining procedure to client, Washing hands, providing privacy, releasing the valve slowly 2 to 3 mmHg/sec, note the sound change and determine when the systole and diastole (first and disappear sound), and Unsure reading completely deflates the cuff with 1to 2 min. then re-inflate again had no statistical difference among the three methods of teaching (Table 2). These results were consistent with **[32, 34]** who stated that during the blood pressure measurement procedure using the stethoscope and sphygmomanometer being a composite of 16 discrete steps, many students experience difficulties with the procedure. Common problems which become potential sources of error include inadequate preparation of the patient, incorrect application of the cuff, failure to locate the pulse sites, ineffective manipulation of the bulb and screw valve, incorrect stethoscope placement, incorrect speed of mercury descent, practices which promote venous congestion in the measurement arm and failure to identify the appropriate blood pressure sounds**.**

Also the present study results were similar to study by **[35]** who measure blood pressure: comparing three different teaching and learning approaches-"demonstration", "a simulation by video", and "demonstration and simulation by video". This study revealed that students who learnt from simulation by video gave more incorrect answers than those who using the other methods, but the average scores for all three groups were very high. Whereas, it was in-line with the study of **[36]** who reported that simulation by video presents visual and audio information simultaneously, making it easier to reach students who learn best through different modalities and learning styles.

Regarding the step of positioning the bell or diaphragm of stethoscope over the brachial artery the present study results revealed that palpated before showed only a statistical significance difference (P=0.001) between assessment I & II in a group "C" only who had taken simulation by video & demonstration and showed no statistical significant difference among the group "A" and "B" (Table 5, 3 & 4). This is contradicted with **[32]** who studied **"**Nursing students' blood pressure measurement following CD-ROM and conventional classroom instruction: a pilot study" and mentioned that group A's better adherence to (positioning of the stethoscope) may be due to the extra reinforcement provided by the CD-ROM which illustrated this aspect of the procedure using close up simulation by video sequences and diagrams. Whereas, the present result was consistent with **[36]** who emphasized on multimedia technology is any technology that integrates multiple types of information, the measures that can be involved at once the more effective and efficient the learning is going to be one of the most important roles of the nurse educator is to select the proper way of teaching blood pressure to prevent or minimize error.

The present study results showed that the group who had taken demonstration "B" and group who had taken demonstration & simulation by video method group "C" had a better result in all steps of assessment I than a simulation by video group "A" with a statistical significant difference (P=0.002) (Table 6). This is also contradicted with **[32]** who studied **"**Nursing students' blood pressure measurement following CD-ROM and conventional classroom instruction: a pilot study" and stated that students who learnt blood pressure measurement by CD-ROM alone (group A) demonstrated greater adherence to the recommended steps of the procedure than students who received the conventional instruction (group B). They showed that the weakest teaching aids was simulation by video; this may be due to first language for the students was not English; level of their attention may be decreased during the simulation by video show, and presence of some distraction as mobile tones accidentally. These results may be attributed to the reason that in order students to develop psychomotor skills and to be competent should be fully integrated into manual development of skills.

Also the present study results revealed that there was no statistical significant difference in the step of deflating the cuff completely and wait for 1 to 2 minutes, then inflate the cuff above the previous reading 30mm

Hg among the three groups in assessment I & II (Table 3, 4, 5). There were two areas of concern with the application of knowledge; 62% of the participants identified the recommended deflation rate. However, when asked the rate of deflation used in their usual practice, only 48% of them choose the correct answer (2 mm/beat) and deflated at this rate in their usual practice. This is perhaps a limitation of the study. Participants may not have found it easy to recall the rate at which they usually deflate the cuff **[5].** This results may be attributed to some factors related to students were in a hurry to finish the procedure, also students may did not realize how much the importance of waiting time before re-inflation process.

It was expected that such junior students would have been initially supervised during BP measurement on their clinical placements so that mentors could ensure their technique was correct and give feedback on their performance. Indeed, **[37]** identifies that the mentor's role includes 'supervising students in learning situations and providing them with constructive feedback on their achievements' **[9]** who studied **"**A survey of first year student nurses' experiences of learning blood pressure measurement" and supports the present study which stated that the group "B" for demonstration was the best in their performance than group "A" for simulation by video or group "C" for simulation by video and demonstration in assessment II with a statistical significant difference (F=10.944).

The present study result revealed that there was no statistical significant difference among the three teaching method either in assessment I or II regarding using auscultation technique in determination of systolic and diastolic pressure (Table 1 & 2) and those contradict The results in (Table 5) which stated that there was a statistical significant difference (P= 0.088) only with group "C" in assessment I or II who had exposed to demonstration and simulation by video method of teaching regarding the step of the procedure which related to auscultation technique in determination of systolic and diastolic pressure. The present study result was on the same line with **[25]** who studied "Development of educational hypermedia to teach an arterial blood pressure measurement procedure" and reported that the construction and assessment process of an educational hypermedia presented, for use in a digital learning environment, with a view to teaching the blood pressure measurement procedure through more than one method, using the auscultation technique. Also, the result was similar to the study of **[4]** who studied "The Effectiveness of Simulation-Based Blood Pressure Training in Preregistration Nursing Students". They reported that the present study was better equipped to determine BP readings that would be experienced in patients in clinical settings; however, we found that supplementary simulation-based tuition does not improve BP accuracy in first-year nursing students. This discrepancy may be attributed to the reason of they had the opportunity for repeated explanation from demonstration and reinforcement through simulation by video.

Finally, the study indicates the comparison among the three types of teaching methods of blood pressure showed that in assessment I demonstration method and demonstration & simulation by video method were better than simulation by video method only with a statistical significant difference. In assessment II the results showed that demonstration method was better than demonstration & simulation by video method and simulation by video method only with a statistical significant difference (Table 6). This is contradicted with **[38]** who studied "effectiveness of simulation-based nursing education depending on fidelity: a meta-analysis" and stated that the results indicate simulation-based nursing educational interventions were effective with particularly large effects in the psychomotor domain. Therefore, it is important to use an appropriate level of simulation to meet all of the educational goals and outcomes. Also it is not consistent with **[32]** who indicates that the CD-ROM may be superior to the conventional form of instruction to convey the theory, reinforce content and learn the many steps of this procedure, however, it is no substitute for real life, hands on experience**.** These results in the study could be due to in assessment I the students were assessed immediately after application of the three teaching methods. This means that there was no bias during this time. On the other hand, during the second assessment; it showed that demonstration method was the best and there was a statistical significant difference (F=10.944). This is due to in the second assessment the student's retention span during demonstration method was better as a result of presence of clinical instructor or demonstrator who gained their attention if any of them lost their attention, also the instructor might have reinforced them regarding the procedure.

To conclude, an audit of nursing students' experiences of learning BP measurement indicated variability in terms of opportunities to practice, equipment used and supervision levels. Supervision during skills performance is necessary to ensure good practice development and confidence improvement. To promote effective, safe patient/client care, as emphasized by **[39]** as it is essential that student nurses experience effective initial skills laboratory preparation, followed by supervised practice and feedback during placements and assessment to ensure skills are being performed safely and effectively.

V. Conclusions

- The Combination of simulation by video & demonstration had a better result in all steps of assessment I than a simulation by video group.
- Demonstration plays an important role in preparing students to competently measure blood pressure in real situation.
- The best method in retention of knowledge and skills after a period of time was the use of demonstration.
- The use of demonstration only and the use of demonstration & simulation by video were equal during immediate assessment.
- Re-practice is very important to improve the student skills of measuring blood pressure and to gain self confidence.

VI. Recommendations

1- For perfect teaching blood pressure measurement; the use of demonstration & simulation by video method in combination while simulation by video should not be used alone.
2- Further consideration should also be given to identify teaching and learning strategies that could be adopted to help overcoming the anxiety students experience in relation to perform blood pressure measurement.

References

[1]. **Gaberson, K., Oermann, M. (2013):** Clinical Teaching Strategies in Nursing, 3rd.,Springer Publishing Company, 0826105823, 9780826105820.
[2]. **Brunt, B. A. (2005) :** Models, Measurement, and Strategies in Developing Critical-Thinking Skills, The Journal of Continuing Education in Nursing, November 2005 - Volume 36 · Issue 6: 255-262. DOI: 10.3928/0022-0124-20051101-05.
[3]. **Taye-Smith, A., Gosling, C., (2005):** An observational Study of student osteopaths` measurement of arterial blood pressure by sphygmomanometery and auscultation, School of health sciences, Victoria University, Australia.
[4]. **Gordon, Ch.J., Frotjold, A., Fethney, Green, J., and Hardy, J.** (2013): The Effectiveness of Simulation-Based Blood Pressure Training in Preregistration Nursing Students, Vol. 8, Number 5.
[5]. **Armstrong RS.** (2002): Nurses' knowledge of error in blood pressure measurement technique International Journal of Nursing Practice, 8(3): 118–126
[6]. **De Freitas,D., Melo,G., Costa,I., Marconato, A., Tibúrcio,M., Torres,G.,(2016):** Failures related to the measurement of blood pressure among nursing students, Rev Rene. Sept-Oct; 17(5):699-706
[7]. **Imai Y. (2014):** Clinical significance of home blood pressure and its possible practical application. Clin Exp Nephrol. 2014; 18(1):24-40.
[8]. **Johnsen, H.M. Fossum, M. Vivekananda-Schmidt, P. Fruhling, A. and Slettebø,A.** (2016): Teaching clinical reasoning and decision-making skills to nursing students: Design, development, and usability evaluation of a serious game, International Journal of Medical Informatics 94 (2016) 39–48.
[9]. **Baillie L, Curzio J.** (2009): A survey of first year student nurses' experiences of learning blood pressure measurement. Nurse Educ. Pract; 9(1): 61-71.
[10]. **Campbell NRC, McKay DW.** (1999): Accurate blood pressure measurement, Canadian Medical Association Journal CMAJ; 161(3): 277-8.
[11]. **Mohan B, Aslam N, Ralhan U, Sharma S, Gupta N, Singh VP, et al., (2014):** Office blood pressure measurement practices among community health providers (medical and paramedical) in northern district of India. Indian Heart J.; 66(4):401-7.
[12]. **Intachai, P., (2014):** Determining the Effectiveness of Three Teaching Methods for Blood Pressure Measurement Skills, Catalyst, ISSN: 2408-137X, Volume 10, No. 2, Institute Press.
[13]. **Jeffries, P.** (2012): Simulation in Nursing Education From Conceptualization to Evaluatoion,2nd ed. National league for nursing, ISBN978-1-934758-15-1.
[14]. **Brecht HD, Ogilby SM., (**2008): Enabling a Comprehensive Teaching Strategy: Simulation by simulation by video Lectures. Journal of Information Technology Education; 7: 71-86.
[15]. **Scalese, R., Obeso, V. Issenberg's., (2007):** Simulation Technology for Skills Training and Competency Assessment in Medical Education, J Gen Intern Med 23(Suppl 1):46–9, doi: 10.1007/s11606-007-0283-4
[16]. **Gaba, D. M.** (2004). The future vision of simulation in health care. *Quality & Safety in Health Care*, 13 Suppl 1, i2-10. doi: 10.1136/qhc.13.suppl_1.i2
[17]. **Lesmeister, K. E., (2003):** Dietary alterations and their influence on rumen development in neonatal dairy calves. Ph.D. Thesis. The Penn State University .
[18]. **Manichander,, T.,(2008):** Emerging Trends in Digital Era Through Educational Technology, Lulu.com,PP.164
[19]. **Available at: http://www.wikipedia.org/. Accessed in: 2009**.
[20]. **Newby TJ, Stepich DA, Lehman JD, Russell JD. (**1996): Introduction to Instructional Technology, Instructional Technology for Teaching and Learning. Englewood Cliffs, New Jersey: Educational Technology Publications, p 48.
[21]. **Aebersold,M. and Tschannen,D. (2013):** Simulation in Nursing Practice: The Impact on Patient Care, The Online Journal of Issues in Nursing, May 2013, vol.18,No.2, Manuscript 6.**DOI:** 10.3912/OJIN.Vol18No02Man06.
[22]. **Seybert, A., Pharm, D., and Barton, Ch.,** (2006): Simulation-Based Learning to Teach Blood Pressure Assessment to Doctor of Pharmacy Students, American Journal of Pharmaceutical Education; 71 (3), 48.
[23]. **Watson R, Stimpson A, Topping A, Porock D.** (2002): Clinical competence in nursing: a systematic review of the literature. Journal of Advanced Nursing 39: 421-431.
[24]. **Dolan, G., (**2003): Assessing student nurse clinical competency: will we ever get it right? Journal of Clinical Nursing 2003; 12: 132–141- UK Accepted for publication 13 March.
[25]. **Alavarce DC, Pierin AMG. (2011):** Development of educational hypermedia to teach an arterial blood pressure measurement procedure. Rev Esc Enferm USP.; 45(4): 933-8 .

[26]. **Oliveira MFL, Neto Brandão W, Silva ARS, Veríssimo AVR, Cavalcante AMTS, Monteiro EMLM**., (2016): Perceptions of students on the physical exams in clinical nursing practice. Rev Rene.; 17(2):268-77.
[27]. **Jairath, N. and Mills, M., (2006): on line health science education development and implementation,** Lippincott Williams & Wilkins, ISBN-13: 978-0781752831, PP 157.
[28]. **Shahin, E. Tork,H., (2013):** Critical thinking and self-directed learning as an outcome of problem-based learning among nursing students in Egypt and Kingdom of Saudi Arabia, Journal of Nursing Education and Practice, 2013, Vol. 3, No. 12. **doi:** 10.5430/jnep.v3n12p103 **URL:** http://dx.doi.org/10.5430/jnep.v3n12p103
[29]. **Nursing assistant on -line simulation by simulation by video lessons** (2004): Wisconsin Technical College. Available at: http://www.wtcsf.com/simulation by simulation by simulation by video/instdesign.htm.,
[30]. **Berman A, Synde SJ, Kozier B, Erb C. Kozier & Erb, (2008):** Kozier & Erb's Fundamentals of Nursing Concept, Process & Practice. 8th Ed. New Jersey: Pearson Prentice Hall, ISBN013-224355-5.
[31]. **Morgan R. (2006):** Using clinical skills laboratories to promote theory-practice integration during first practice placement: an Irish perspective. Journal of Clinical Nursing; 15(2): 155-61.
[32]. **Bauer MD, Huynh MV.** (1998): Nursing students' blood pressure measurement following CD-ROM and conventional classroom instruction: a pilot study. International Journal of Medical Informatics; 50: 103-9.
[33]. **Almeida T., and Lamas J. (**2013): Nurses of adult intensive care unit: evaluation about direct and indirect blood pressure measurement. Rev Esc Enferm USP.; 47(2):364-71.
[34]. **Torrance C, Serginson E**. (1996): Student nurses' knowledge in relation to blood pressure measurement by sphygmomanometry and auscultation, Nursing Education Today; 16: 397-402.
[35]. **Larkin, P., et al., (2000):** Learning to measure blood pressure: comparing three different teaching and learning approaches –written instructions, a PowerPoint presentation and streaming simulation by simulation by video. Available at: http://www.lifesign.ac.uk/casestudy1.asp.
[36]. **Cruse E. (2007).** Using educational simulation by video in the classroom: Theory, research and practice Wynnewood, PA: Library Simulation by simulation by video Company. Available at: http://www.library simulation by video.com/articles/article26.asp.
[37]. **Nursing and Midwifery Council.** (2006): Standards to Support Learning and Assessment in Practice: NMC Standards for Mentors, Practice Teachers and Teachers. London: NMC.
[38]. **Kim,J., Park,J., and Shin,S.** (2016): Effectiveness of simulation-based nursing education depending on fidelity: a meta-analysis.
[39]. **Nursing and Midwifery Council,** (2007): Introduction of Essential Skills Clusters for Pre-registration Nursing Programmes. NMC circular.