Nursing Students' Perception About The Usability And Efficiency of Virtual Laboratories

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Abstract

Background: Virtual labs have been demonstrated to be as effective or possibly more effective for student learning across a broad set of students and have shown relative agreement on the usefulness of virtual labs for topic knowledge and cognitive growth. **Aim of the study:** Assess nursing students' perception about usability and efficiency of virtual laboratories. **Design:** A descriptive analytical design was used to conduct this study. **Setting:** The study was conducted in the academic structure at faculty of nursing Ain shams university, Cairo. **Sample**: A stratified sample composed of 323 students, were chosen by simple random sample from the previously mentioned setting. **Tools of data collection:** two tools were used to collect the data, **1st tool:** "Self-administered questionnaire", which include 3 parts, Part I: Nursing student's socio-demographic characteristics. Part II: Nursing student's knowledge about virtual laboratory. Part III: Nursing student's reported practices regarding usability of virtual laboratory **2nd tool:** Attitude scale (Likert scale) to assess nursing students' attitude about virtual laboratory adapted from (Turkey., 2022)**. Results:** 68% of the studied nursing students had a satisfactory level of total knowledge. 62.8% of the studied nursing students had done reported practices. 72.1% of the studied nursing students had positive attitude regarding usability and efficiency of virtual laboratory. **Conclusion:** There was a highly statistically significant relation between the total level of knowledge of students and their reported practice. A highly statistically significant relation between the total level of knowledge of students and their attitude and a highly statistically significant relation between total reported practices of students and their attitude. Also, there was a highly statistically significant strong positive correlation between total level of knowledge, total practice, and total attitude. **Recommendations:** Increase nursing students' awareness of virtual laboratories by organizing comprehensive workshops and training courses. Further research with larger samples with the teachers and students from other universities doing health science degrees (medicine, pharmacy, psychology, etc).

Keywords: virtual laboratory, nursing students' perception, usability, efficiency.

Introduction:

Learning technology apps have become an essential component, Due to the recent digital change in the teaching and learning process. These programs would let teachers effectively accomplish learning objectives and deliver engaging learning material. As a result, numerous educational institutions are using a variety of applications, including mobile learning apps, virtual learning systems, and distance learning systems. Several specialized learning platforms in various fields have emerged as a result of the rise of remote and blended learning in schools and colleges ***(Bdair, 2021).***

A virtual lab (V lab) can be defined as an online environment that consists of a set of experiment simulations and videos, which allow students to run experiments virtually and has the potential to support and enhance face-to-face practical-based learning. Students can learn scientific concepts and gain new skills using virtual labs anytime and anywhere, using only their laptops or even smartphones ***(Atchia & Rumjaun,2023).***

Virtual labs have been demonstrated to be as effective or possibly more effective for student learning across a broad set of students and have shown relative agreement on the usefulness of virtual labs for topic knowledge and cognitive growth. When compared to traditional hands-on laboratories, virtual laboratories can provide advantages including lower costs, greater accessibility, time savings, safe surroundings, and

the flexibility of self-regulated learning According to a global survey conducted by the World Economic Forum (WEF) on what higher education will look like in 2025, 72 percent of over 27,500 respondents predict that hybrid learning models will be the norm by 2025 ***(Chan et al., 2021)***

Perception is the collection of information obtained from external environments; the channels of perception are responsible for acting on research and organizing information, which contributes to the learning process. Channels reflect how basic stimuli affect a person's ability to absorb and recall information. Perception is one of the important psychological aspects because by it we know about phenomena that exist in our environment. It can be positive or negative ***(Torbergsen et al., 2023).***

Significance of the Study:

Many challenges that stand in the way of Egypt's higher education system prohibit it from developing. With the threat of today and the need for social distance, the current educational model is insufficient. The whole curriculum of universities around the world must now be taught online. This includes making extensive use of the e-learning model, which presents numerous challenges for students, academic staff, and universities. Yet, e-learning uptake and utilization in Egypt are still in their infancy. E-learning needs to overcome a lot of challenges before it can be widely adopted ***(Saad Abd El-Aty et al., 2022).***

Reinforcing scientific knowledge, fostering problem-solving skills, and encouraging critical thinking are some benefits of using virtual labs in undergraduate nursing education. They aid in students' understanding of the nature of science and the perspectives of experts. Furthermore, current research conducted during the COVID-19 pandemic has revealed that they have effectiveness comparable to that of on-site laboratories ***(Sáiz-Manzanares et al., 2022).***

Aim of the study:

The aim of this study is to assess nursing students' perception about usability and efficiency of virtual lab through:

1. Assessing nursing students' knowledge about usability and efficiency of virtual lab.
2. Assessing nursing students' reported practice about usability and efficiency of virtual lab.
3. Assessing nursing students' attitudes about usability and efficiency of virtual lab.

Research Question:

1- Is there a relation between nursing students' knowledge and their reported practices about virtual lab?
2- Is there a relation between nursing students' knowledge and their attitude about virtual lab?
3- Is there a relation between nursing students' reported practice and their attitude about virtual lab?

Subjects and Method

The subjects and methods used to achieve the previous aim were discussed under the following designs:

I. Technical design:

The technical design used for the study includes three main categories: research design, setting, sampling of the study as well as tools of the data collection

Research design:

Descriptive analytical study was utilized in carrying out this study. This design is concerned with description of phenomenon of interested focuses on a single group or population characteristics without trying to make interference ***(Pawar, 2020).***

Research Setting:

The study was conducted in the academic structure at faculty of nursing Ain shams university. It contains eight scientific departments that use virtual laboratory in their clinical areas. This setting was selected especially due to the application of the study technique using virtual laboratories that were established in 2022 and implemented in 2023.

Study Subjects:

- **Type:**

A stratified sample was used for total sample size selection and a simple random sample for selecting each subject were used.

- **Sample size calculation:**

The estimated sample size is 323 out from 2014 students, at confidence level 95% (***Mishra, S. B., & Alok, S. 2022).***

$$n = \frac{N \times p(1-p)}{\left[\left[N-1 \times \left(d^2 \div z^2\right)\right] + p(1-p)\right]}$$

Which:

n= 323
N= 2014
Z= 1.96
d= error level 5%
p= 0.5

- **Sample technique:**

Based on the probability stratified sampling technique, according to **Sharma, (2023)** stratified sampling in which the target population is first separated into mutually exclusive homogeneous segments (strata), and then elements are selected through a simple random sample from each segment (stratum). Select students enrolled in the Baccalaureate nursing program during each of the four academic years, faculty of nursing, Ain shams University during the academic year 2023/2024. The equation was created to take the appropriate number from each grade and choose each number randomly

Data collecting tools:

Two tools were used for data collection

First tool: A self-administered Questionnaire designed by the investigator and written in simple Arabic language to gather data which concern the aim of study and consists of the following parts.

Part I: Nursing student's socio-demographic characteristics:

composed of five closed ended questions **(Q1-Q5)** as: age, gender, Place of residence, Place of living, academic year.

Part II: Knowledge of nursing students to assess usability and efficiency about virtual laboratories adapted from (Kolil, V. K., & Achuthan, K. 2023), and modified by the investigator to meet the aim of the study:

composed of 11 closed ended questions **(Q6-Q15 and Q18)** as: (Definition of virtual lab, reasons for using virtual lab, the educational benefit of virtual laboratories, the environmental benefit of virtual laboratories, the economic benefit of virtual laboratories, the obstacles of using virtual laboratories for the educational environment, the obstacles of using virtual laboratories for the students, the obstacles of the virtual laboratories for practical courses, the advantages of using virtual labs, the disadvantages of virtual labs and source of information. Two open questions **(Q16-Q17)** as: the extent of benefit from virtual laboratories, the difference between virtual laboratories and the traditional laboratories in acquiring the practical skills required for the nursing course.

❖ **Scoring system**

Total knowledge questions composed of 12 questions, each correct answer was scored 1degree, and the incorrect answer was scored zero. The total questions grade was 12 degrees. The total score of the knowledge assessment for every student's was summed-up and converted into a percent score ≥50% (6 – 12 degree) considered satisfactory and <50% (< 6 degree) considered unsatisfactory, the question related to source of information was excluded from the scoring system.

Part III: Reported practices of nursing students to assess usability of virtual lab adapted from (Rosli & Ishak,2022), and modified by the investigator to meet the aim of the study:

composed of twenty closed ended questions divided as 5 closed ended questions general reported practices **(Q 19-Q23)** as: device used to access virtual labs, previous training on how to use virtual labs, Sufficiency of training period, Numbers of times virtual lab use daily, Time spent using the virtual lab. 15 closed ended questions **(Q1-Q15)** as: Proficiency in using virtual laboratory, conducting nursing activities before performing them in the traditional laboratory, periodically use of virtual labs, Relied on the use of the virtual laboratory instead of the traditional laboratory.

❖ **Scoring system**

Reported practices included 15 statement. the maximum possible total score was 15 degrees, each done reported practice scored 1 and not done reported practice scored 0, total score of reported practices were summed up and converted into percent score, categorized as the following: done ≥ 60% (9 - 15 degree) and not done less than 60% (<9 degree). The five questions related to general reported practices was excluded from the scoring system.

Second tool: Attitude scale to assess Nursing students' attitude about virtual laboratory (Likert scale) adapted from (Turkey, J. A. R., & Al-Sbou, M. K. K. 2022), *and* Modified by the investigator to meet the aim of the study to assess nursing students' attitude about virtual laboratory:

Included (52) phrases. The scale included some statements such as (efficiency of virtual lab (13) statements, usability (9) statements, Satisfaction with the program (21) statements, obstacles (9) statements).

❖ **Scoring system**

The scale composed of 52 statements, included clear statements of positive and negative attitude of nursing students, the scale included 3 scale score ranging from agree = 3 nutrient = 2 disagree = 1. The total score of total attitudes was scored 156. categorized as the following Positive attitude if the score was ≥60 % representing 94 or more. Negative attitude if the score was <60% representing less than 94. The score was reversed for negative statements such as (12,22,25,26).

II. Operational Design

The operational design included three phases namely: preparatory phase, pilot study and fieldwork.

A- Preparatory phase

It included reviewing past and current, national, and international related literature using books, articles, journals, periodicals, and the internet to be acquainted with the subjects of the study and tools of data collection.

Content validity

The tools of data collection in this study.it was tested for appropriateness, relevance, correction, and clearance through a jury of (3) experts, three professors from Family and community health nursing staff at the faculty of nursing Ain shams university.

Content reliability

the previous tools were tested by **Cronbach alpha** test of reliability, the tools proved to be strongly reliable tools.

Items	Cronbach' alpha test
Knowledge	**0.69**
Practice	**0.90**
Attitude	**0.85**

B- Pilot study

A pilot study was carried out after modifying the tools and before starting data collection. It was conducted on (10%) of the total sample representing (32) to ensure the clarity and feasibility of the questions and the applicability of the tools and the time needed to complete the tool. No modifications were done, so the sample of pilot study included in the study.

C- Field Work

The fieldwork of the study started at the beginning of October 2023 till the ending of December 2023 (3 months). after securing the official approvals for conducting the study. The investigator arranged with the head of the scientific departments of each grade for determining the suitable time to collect the data. The investigator used stratified sample for total sample size selection and a simple random sample for selecting each subject to collect tools in their classrooms or during break time. The investigator introduced himself to nurse students in the classroom then explained the aim and components of the questionnaire sheets. The investigator distributed the questionnaires in groups and asked study subjects to fill them out. Questions were clearly explained in a standard way to minimize errors in interviewing. Each interview took from 20-30 minutes. Data was collected for 2days/week and every day collected around 12-14 sheets. The investigator checked each filled questionnaire sheet to ensure its completion.

Ethical considerations:

The study took approval the scientific research from ethical Committee of the Faculty of Nursing, Ain Shams University. The investigator met the students in the groups to explain the purpose of the study and to obtain their agreement to participate. Oral consent was obtained from university students. Students were reassured about the anonymity and confidentiality of the information collected, that it was used only for scientific research, and that their right to withdraw from the study at any time would be guaranteed.

III. Administrative design

Before starting on the study, letters were issued from the Head of the Family and Community Health Nursing Department to the Dean of Faculty of Nursing, at Ain Shams University, the letter explained the aim of the study to facilitate data collection phase. The researcher explained the importance of the study and the implication of expected results for the study subjects.

IV. Statistical Design

The collected data from nursing students were coded and entered in a special format using Statistical software to be suitable for computer analysis. Following data entry, a checking and verification process was carried out to avoid any errors. The following statistical package for Social Science SPSS (Version 22.0). The obtained data were organized, analyzed, and represented in tables and graphs as required. Data were presented using descriptive statistics in the form of number, percentage, mean score, standard deviation. For investigation correlation between variables using Pearson correction test, and chi square test. Indication a highly statistically significant between variables at $p<0.01$.

Significance of the results:

- P-value > 0.05 Not significant (NS)
- P-value ≤ 0.05 Significant (S)
- P-value ≤ 0.01 Highly Signific

Results:

Table (1): Reveals that 60.1% of nursing students' ages <21 years old with a mean age of 20.21±1.04. As for gender 57.6 %of them were females. Concerning place of residence 60.1% were coming from urban area. Regarding accommodation type, 65% lived in their family homes. For grade, 31.9% was first year.

Figure (1) Illustrates that 68% of the studied nursing students were satisfactory level of total knowledge regarding usability and efficiency of virtual lab. While 32% of them were unsatisfactory level of total knowledge

Figure (2): displays those 62.8% % of students had done reported practices about usability and efficiency of virtual lab. Also, 37.2% of students hadn't done reported practices.

Figure (3): displays that regarding total nursing students' attitude about usability and efficiency of virtual lab, 72.1% of students had a positive attitude and 27.9 % had negative attitude.

Table (2): shows that there is a highly statistically significant relation between total level of knowledge and total practice among nursing students regarding usability and efficiency of virtual lab.

Table (3): shows that there is a highly statistically significant relation between total level of knowledge and total attitude among nursing student's regarding usability and efficiency of virtual lab.

Table (4): shows that there is a highly statistically significant relation between total practice and total attitude among nursing students regarding usability and efficiency of virtual lab.

Table (5): Illustrates that there is a highly statistically significant strong positive correlation between total level of knowledge, total practice, and total attitude among nursing students regarding usability and efficiency of virtual labs.

Table (1): Nursing students' personal data (n=323)

Nursing students' personal data	nurse's student (n=323)	
	N	**%**
Age (year)		
<21	**194**	**60.1**
21-22	129	39.9
Mean±SD	20.21±1.04	
Gender		
Male	137	42.4
Female	**186**	**57.6**
Place of residence		
Urban	**194**	**60.1**
Rural	129	39.9
Accommodation type		
Family home	**210**	**65**
University home	62	19.2
Shared accommodation with colleagues	28	8.7
Separate housing	23	7.1
Grade		
1st year	**103**	**31.9**
2 nd year	91	28.2
3rd year	86	26.6
4 th year	43	13.3

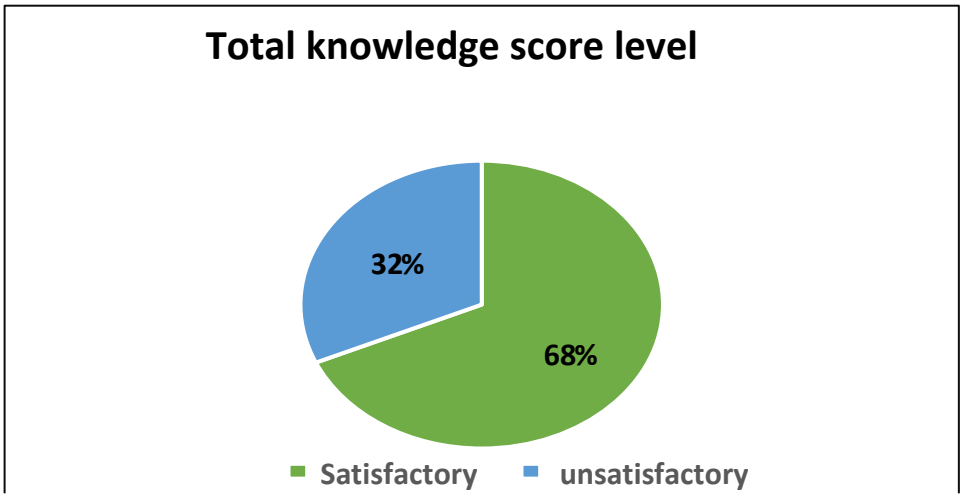

Figure (1): Percentage distribution of the studied nursing students according to their total knowledge regarding usability and efficiency of virtual lab (n = 323).

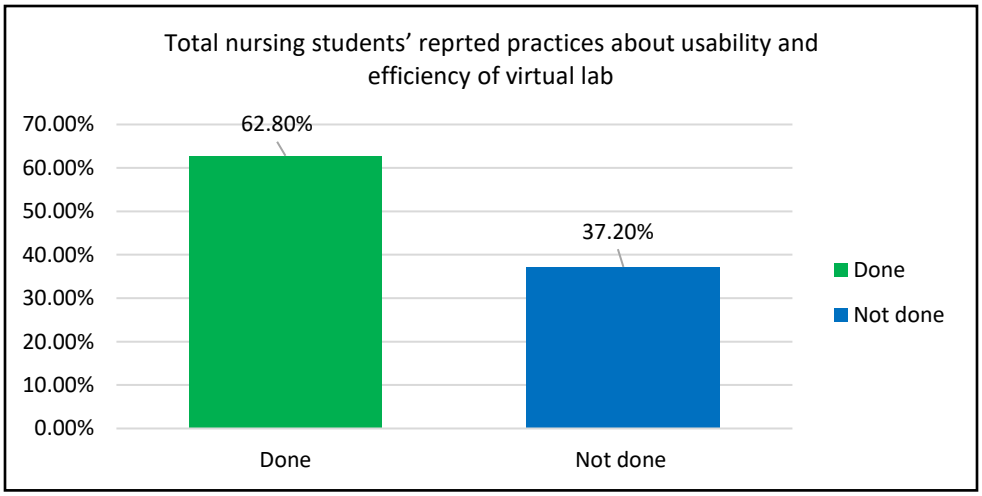

Figure (2): percentage distribution of Total studied nursing students' reported practices about usability and efficiency of virtual lab(n=323)

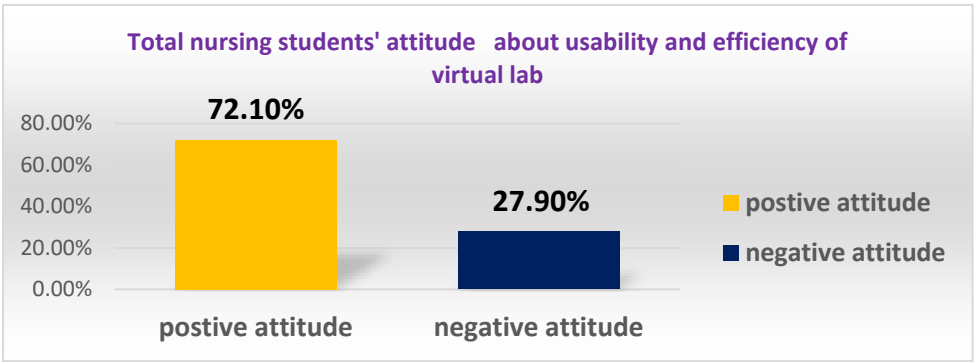

Figure (3): percentage distribution of Total studied nursing students' attitude scale about usability and efficiency of virtual lab (n=323)

Table (2): Relation between total level of knowledge and total level of reported practices among nursing students regarding usability and efficiency of virtual lab (n=323). **related to research question No.1**

Total level of Knowledge	Total level of Reported practices				χ^2	P value	sig
	Done		**Not done**				
	No	**%**	**No**	**%**			
Satisfactory	197	61	23	7.1	210.594	.000**	S
Unsatisfactory	6	1.8	97	30.1			

Table (3): Relation between total level of knowledge and total level of attitude among nursing students regarding usability and efficiency of virtual lab (n=323). **related to research question NO.2**

Total level of Knowledge		Total level of Attitude				χ^2	P value	sig
		Positive		**Negative**				
		No	**%**	**No**	**%**			
Satisfactory		217	67.2	3	0.9	241.041	.000**	S
Unsatisfactory		16	5	87	26.9			

Table (4): Relation between total level of reported practices and total level of attitude among studied nursing students regarding usability and efficiency of virtual lab (n=323). **related to research question NO.3**

Total level of Attitude	Total level of Reported practice				χ^2	P value	sig
	Done		**Not done**				
	No	**%**	**No**	**%**			
Positive	202	62.5	31	9.6	203.662	.000**	**S**
Negative	1	0.3	89	27.6			

Table (5): Correlation between total level of knowledge, total practice, and total attitude among studied nursing students regarding to usability and efficiency of virtual lab (n=323).

Items		Total practice	Total level of knowledge	Total attitude
Total practice	Pearson Correlation	1	0.807	0.794
	Sig. (2tailed)		.000**	.000 **
	N	323	323	323
Total level of knowledge	Pearson Correlation	0.807	1	0.864**
	Sig. (2tailed)	.000**		.000
	N	323	323	323
Total attitude	Pearson Correlation	0.794	0.864**	1
	Sig. (2tailed)	.000 **	.000	
	N	323	323	323

Discussion:

Concerning nursing students' personal data, the result of the current study revealed that more than half of nursing students were aged less than 21 with a mean age of 20.21±1.04 years, and more than half of them were females. According to a place of residence, more than half of nursing students were coming from urban areas. Regarding the Accommodation type nearly two-thirds lived in their family homes. Also, less than one third was in the first year **(Table 1).**

This result agrees with ***Thompson et al., (2020)*** under the title "Nursing students' engagement and experiences with virtual reality in an undergraduate bioscience course" who conducted a study in Canada sample size 46 first year nursing students and found that, 70% of them aged 18-20 with the mean age 19±3.31years. They also reported that 91 % of them were females.

This result also agrees with ***Apsari et al., (2023)*** under the title "Virtual Reality Effectivity to Increase Self-Efficacy in Suction Skill Among Nursing Student: Quasi Experiment Study." who conducted a study in Padjadjaran sample size 191 nursing students and found that, 48.5% of them aged from 18-20 with the mean age 18±3.31years. They also reported that 86.6 % of them were females.

This result in disagreement with the study conducted by ***Saab et al., (2021)*** entitled "Incorporating virtual reality in nurse education: A qualitative study of nursing students' perspectives" who conducted a study in Ireland sample size 26 students and found that, 90% of them aged from 20-40 with the mean age 23.6±3.31years.

From the investigator's point of view, these results may be due to the younger can deal with new technology, females have more time for experimentation and the urban area has availability to all modern learning methods and good internet access. Whenever the student is stable in his home, this helps him to learn well.

Concerning their total knowledge score level among students about the usability and efficiency of the virtual lab. The result of the current study revealed that less than three-quarters of students had a satisfactory level of total knowledge about the usability and efficiency of virtual labs **(Figure 1)**.

This result was approved with ***Zhang et al., (2024)*** entitled " The Impact of virtual clinical simulation on nursing students' palliative care Knowledge, ability, and Attitudes: A Mixed-methods study " who conducted a study in China sample size 96 students and found that, 80.3% of them had satisfactory level regarding total knowledge.

Also These results in agreement with the study conducted by **Massey et al., (2021)** entitled "A comparison of non-traditional online and traditional wet-lab experiences in human anatomy and physiology: An innovative approach for pre-licensure nursing education " who conduct a study in USA sample size 63 students stated that, nonetheless, the average levels of satisfaction in all of the subjects(100%) were medium-high and the students reported that using virtual labs had helped them to better understand the theoretical and practical content of their subjects.

From the investigator's point of view, this may be due to VR enhancing the link between theory and practice for students, through repeated exposure to content and related clinical skills.

As regards reported practices total score level about usability and efficiency of virtual lab, the current study result showed that more than half of the nursing students had done practice while more than one third of them had not done practice **(Figure 2)**.

This results in agreement with the study conducted by ***Kim, et al (2021)*** entitled " Adaptation of Extended Reality Smart Glasses for Core Nursing Skill Training Among Undergraduate Nursing Students: Usability and Feasibility Study "who conducted a study in f Korea's high student-faculty sample size 30 students and found that, Approximately two-thirds of participants (22/30, 73%) reported possessing a moderate level of competency in core nursing skills.

Also, this results in agreement with ***Luctkar-Flude et al., (2021)*** entitled " Designing a Virtual Simulation Game as Pre simulation Preparation for a Respiratory Distress Simulation for Senior Nursing Students: Usability, Feasibility, and Perceived Impact on Learning " who conducted a study in Canada sample size 92 students and found that, 76% reported practices about the usability of virtual lab.

In the light of total nursing students' attitude about usability and efficiency of virtual lab. The current study showed that less than three quarters of students had a positive attitude **(Figure 3)**.

This study was consistent with ***Kapici et al., (2020)*** entitled "How do different laboratory environments influence students' attitudes toward science courses and laboratories?" who conducted a study at Turkey sample size 143 students and revealed the highest mean score (M=4.14) regarding attitude of virtual lab.

Also, second study was agreement with ***Cheng & Tsai, (2020)*** who study conducted in Taiwan among 76 students entitled" Students' motivational beliefs and strategies, perceived immersion and attitudes towards science learning with immersive virtual reality" and indicated that highest mean attitude score (M = 4.38) regarding virtual labs.

This result contraindicated with the results of the study conducted by ***AlBalawi, (2022).*** Under the title "Health Sciences Students' attitude, perception, and experience of using Educational Simulation in Saudi Arabia: a cross-sectional study" who conducted a study at the Prince Sultan Military College of Health Sciences in Saudi Arabia sample size 246 students and indicated that 54% of the participants had positive attitudes towards simulation-based education.

From the investigator's point of view, this may be due to students had satisfactory knowledge and practice regarding virtual lab. So, students had a positive attitude regarding virtual labs.

In the light of relation between total level of knowledge and total level of reported practices among nursing students' regarding usability and efficiency of virtual lab. The present study indicated that there was a highly statistically significant relation between total level of knowledge and total practice among nursing students regarding usability and efficiency of virtual lab **(Table 2)**.

The findings study was agreement with ***Penn, & Ramnarain, (2019)*** entitled "South African university students' attitudes towards chemistry learning in a virtually simulated learning environment" who conducted a study at South Africa sample size 50 students and indicated that there was relation between knowledge and students' practice.

From the investigator's point of view, this may be due to faculty was frequent done orientation for usage of virtual lab and training, so students had satisfactory knowledge and practice regarding virtual lab.

Concerning the relation between total level of knowledge and total level of attitude among nursing students' regarding usability and efficiency of virtual lab. **(Table 3)**.

This study was consistent with ***Alsoufi et al., (2020)*** entitled "Impact of the COVID-19 pandemic on medical education: Medical students' knowledge, attitudes, and practices regarding electronic learning" who conducted a study at Libya sample size 12,000 and revealed that there was relation between knowledge and attitude of electronic and virtual learning.

From the investigator's point of view, this may be due to students' knowledge affecting attitude regarding virtual lab.

In the light of relation between total level of reported practices and total level of attitude among nursing students' regarding usability and efficiency of virtual lab. The current study indicated that there is a highly statistically significant relation between total practice and total attitude among nursing students regarding usability and efficiency of virtual lab **(Table 4).**

This study was consistent with ***Lange et al., (2020)*** entitled "Learning with virtual reality in Nursing education: Qualitative interview study among Nursing students using the unified theory of acceptance and use of technology model" who conducted a study at Germany sample size 100 nursing students and indicated that was relation between practice and application leads to positive attitude.

From the investigator's point of view, this may be due to easy and quick access to a virtual lab, students can use learning materials more effectively and apply learning concepts better, leading to improved understanding and practical application.

Concerning correlation between total level of knowledge, total practice, and total attitude among nursing students regarding usability and efficiency of virtual lab. **(Table 5)**.

This study was consistent with ***Bianco., (2022)*** entitled "The Impact of Lab Delivery Method on Student Achievement, Transfer of Learning, and Self-Perception in an Anatomy and Physiology Course" who conducted a study at United States sample size 99 students, virtual lab knowledge impact significantly on performance and attitude of students.

Also, study was consistent with ***Hudder et al., (2021)*** entitled " A Quasi-Experimental Study Comparing Virtual Simulation to Lab-Based Learning of Newborn Assessment Among Nursing Students" who conducted a study at Canada sample size 39 students demonstrated that clinical simulation is an effective for nursing education, enhance practice and attitude of students.

From the investigator's point of view, the use of virtual laboratories leads to a change in educational practices and the adoption of new and more effective methods, which positively affects students' attitudes and increases their level of knowledge and understanding.

Conclusion:

Based on the research questions and the study findings it was concluded that:

More than two-thirds of studied students had satisfactory level of total knowledge regarding usability and efficiency of virtual laboratory. more than half of students had done reported practices. more than two-thirds of the studied nursing students were having positive attitude. Moreover, there was a highly statistically significant relation between the total level of knowledge of students and their total reported practices. Additionally, there was a highly statistically significant relation between total level of knowledge of students and their total attitude. there was a highly statistically significant relation between total reported practices of students and their total attitude. Also, there was a highly statistically significant strong positive correlation between total level of knowledge, total practices, and total attitude.

Recommendations:

In the light of the findings of the current study the following recommendations can be suggested:

1- Increase nursing students' awareness of virtual laboratories by organizing comprehensive workshops and training courses.

2- Further research with larger samples with the teachers and students from other universities doing health science degrees (medicine, pharmacy, psychology, etc)

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