

## Designing and Implementing Virtual Classes about Medication Safety among Intern Nurses

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### Abstract

**Background:** A virtual learning environment allows intern nurses' engaged in education which enables the acquiring theoretical and practical skills regarding medication safety without limitations of time and place. **The study aimed at** designing and implementing virtual classes about medication safety among intern nurses. **Design:** A quasi-experimental design was utilized. **Setting:** The study was conducted in the intern-nurses' clinical training areas at Benha University Hospital. **Subjects:** Consisted of 60 intern nurses from 2020-2021 representatives. **Tools:** Four tools were used, (1) Virtual classes knowledge questionnaire, (2) Attitude toward virtual classes questionnaire, (3) Observational checklist for safety measures regarding medication administration and (4) Virtual classes. **The study results** showed that the most of intern nurses had poor knowledge related to virtual classes and medication safety dimensions at pre- intervention phase, which it improved to be the most of them had good knowledge at post intervention phase with slightly decreased to be at follow-up phases. The majority of intern nurses had a negative attitude toward virtual classes at pre-intervention phase, which improved to be majority of them had positive attitude respectively at post and follow-up phases. The majority of intern nurses had low practice level at pre- intervention phase, while it improved to be the majority of them had high practice level at post phase, with slightly decreased to be three quarters of them had high practice level regarding medication administration safety at follow-up intervention-phases. **Conclusion:** Applying virtual classes about medication safety had a highly statistically significant improvement of intern nurses' knowledge, attitude toward virtual classes and practice of medication safety. **The study recommended** evaluating faculty virtual classes' implementation process and assessing the obstacles of the implementation of virtual classes and put different strategies for solving it.

**Keywords:** Designing, Intern nurses, Medication safety, Virtual classes

### Introduction

A virtual classroom is a digital learning environment replica of a traditional classroom or training room. The instructors teach, and the intern nurses learn in real-time, but via internet-enabled technology devices, where instructors and intern nurse connect online in real-time (Clark & Gibb, 2021). It is a scheduled, online, instructor-led training session where instructors are not present with

participants physically but interact via internet (Frank, 2020).

A virtual classroom is a concept of supporting current educational organizations with the means of easy learning, better administration and more technology-orientated way of learning with the help of the internet that makes studying more interesting and easy to understand for the students/ participants (Wang & Newlin, 2021).

Virtual classroom is accessing to advanced knowledge and educational experiences. Delivering learning services to all needed people. Increase the interaction environment by sharing some materials. Improving the quality of education by using the computer to support a collaborative learning environment. Reducing learning expenses. Remove many hassles on instructors by adding electronic materials. Easy to use and improve flexibility and convenience (Alahmari, A., 2019).

Virtual classroom is flexible, affordable, and non-restricting learning environment. It enables the student/ intern nurse to record the provided information as it happens. With that, the student/ intern nurse can easily access all the visual and audio presentations. To be precise, the content remains accessible even after it has been delivered and intern nurses can have a quick refresher if they fail to fully comprehend it the first time. Virtual classroom offers many benefits to students/ intern nurse as: Launch remote and risk-free training programs, self-paced learning, time management, self-motivation, improved communication, and collaboration, refined critical-thinking skills and technical skills (Ralecon, 2022).

When looking for a virtual classroom solution, consider the features as interactivity, use screen sharing, highly scalable, management of content, easy-to-administer classes, contact on high-quality voice and video, improve reliability and performance, integrate social learning, require high levels of security, secure file sharing, real-time instant messaging, digital whiteboard, third-party integration, centralized repository, customizable reporting (Boskovic, 2020).

The widespread use of technology nowadays offers learners and teachers different tools which can facilitate language learning and teaching across universities in different parts of the world. With the ability of the internet to cut

across demographic boundaries online, education has rapidly become not just an acceptable pedagogy, but one that is in strong demand (Huguet, Pearse and Esteve, 2021). The tools of virtual classes contain: Mobile training unit: mobile learning app, videoconferencing: the video feed and the chat, online whiteboard for real-time collaboration, screen sharing, the course feed, breakout rooms, chatting rooms and presentation tools (Gautam & Tiwari, 2020).

A virtual classroom, the teacher has the important role of guiding the intern nurses and also supporting them during group activities and discussions. Live collaboration and Communication. Supports all devices. Communicate via video, voice, and chat. Easy Sharing Doc and PDF File. Available class wise and Intern nurse wise filters Intern nurse can easily record the lectures. Easily track student's progress. Live screen sharing. Live streaming (Coman, îru, Meses, Stanciu and Bularca, 2020).

A Virtual classroom “means a teacher-led remote learning environment conducted in real time using video conferencing technology to deliver a broad array of solutions that enhance knowledge and performance and in which students are taught the standards and guidelines of patient safety and medication safety. The global landscape of health care and patient safety is changing, and health systems operate in increasingly complex environments. While new treatments, technologies, online learning, and care models can have therapeutic potential, they can also pose novel threats to safe care (Ricciardi & Cascini, 2021; Dill & Cruz, 2022; (WHO), 2022).

Medication safety is important for universal health coverage and the sustainable development goals for several reasons. Firstly, it has been shown that most of the burden of iatrogenic harm is associated with a small number of common adverse events, one of

them being medication error. Secondly, medication is a common health care intervention, and is a key part of preventative, curative, rehabilitative and palliative health care. Finally, an important component of medication safety is the challenge of antimicrobial resistance (AMR), which is particularly relevant in the context of tackling diseases such as tuberculosis, human immunodeficiency virus (Myrtle & Ruth, 2022).

Medication safety, defined as the freedom from accidental injury due to medical care or medical errors during the medication-use process, deserves the same prioritization, given the scope of medication use in patient care and the frequency and severity of potential harm (Despins & Cawiezell, 2020; Fusco, Alfes, Weaver and Zimmermann, 2021).

The intern nurses, is a position for students currently enrolled in an accredited registered nurse program who have completed a fundamentals of nursing or Medical Surgical course. (Qais, Alkhalaileh, Gutierrez, Alatawi, Cabaltica et al., 2020).

The main responsibilities of a intern nursing involve taking care of patients under the guidance of a registered nurse or a doctor. They should also perform duties such as providing health care in clinical or nursing settings to the clients and should have good communication skills. Responsibilities include preparing charts, assessment of the patient's recovery, discharge of the patient and educating the patient if required based on logical evidence (Recruiter, 2022).

### **Significance of the study**

Many universities and colleges around the world now engage online classes and programs to allow access to higher education without geographical barriers (Mia, 2022). In the new arena of learning, technology is playing an important role than ever before. Teaching and learning are slowly moving into more of digital

space and outsmarting the traditional classroom system. Moreover, the Covid situations are demanding a great emphasis on online education and that is the reason why e-learning tools are gaining a lot of attention. When the world is moving towards virtual education, there needs a strong platform that connects well between instructors and intern nurses (Parker& Martin, 2022).

Today, about 3 in every 4 students claim that they learn better via online classes. This means that 3 out of 4 students still feel they perform better in a traditional classroom setting. Moreover, instructors are also looking for some outstanding tools to fill the gaps in classroom education when they are forced to deliver the teaching remotely. Experts always suggest instructors not to depend on a single tool but to try multiple platforms and experience the benefits of many for outstanding results (Wilkinson, 2021; Collins & Berge, 2022).

From the researchers' point of view as an instructor preparing classes for teaching requires capabilities, expenses, equipment, and instruments to contain and teach a large number of intern nurses. Therefore, teaching through virtual classes is cheaper, easier, safer, protector from spread of covid19 and other communicable diseases and isn't limited to intern nurses whether studying in colleges or institutes (under-graded or post-graded), or after the end of the different education stages. So the present study aims to designing and implementing virtual classes about medication safety among intern nurses.

### **Aim of the Study**

This study aims at designing and implementing virtual classes about medication safety among intern nurses by: assessing intern nurses' knowledge regarding virtual classes' about medication safety, identifying intern nurses' attitudes towards virtual classes' before and after implementing the virtual classes,

assessing intern nurses' practice regarding medication safety through virtual classes, designing and implementing virtual classes about medication safety among intern nurses; and evaluating the effect of implementing virtual classes on intern nurses' knowledge and practice regarding medication safety.

### **Research Hypothesis**

Applying virtual classes about medication safety significantly expected to improve intern nurses' knowledge, attitude and practice regarding medication safety.

### **Subjects and Method**

#### **Design**

A quasi-experimental study was utilized to achieve the aim of the current study.

#### **Setting**

The current study was conducted in the intern-nurses' clinical training areas at Benha University Hospital, the total number of beds at this hospital is 880. The hospital composed of three separated buildings: Medical building 478 beds, surgical building 384 beds and ophthalmology building 18 beds. The intern-nurses' clinical training areas according to the policy of internship.

#### **Subjects**

The subjects who participated in this study were composed of representative sample consisted of 25% of intern nurses of Benha Faculty of Nursing who were enrolled in the internship year 2020/ 2021 at Benha University Hospital and having advanced mobile device. The total number of intern-nurses was 240 intern-nurses at the time of the study, so the actual number of intern-nurses included in this study was 60 chosen randomly.

#### **Tools of data collection**

Data of the present study was collected by using four tools as following:

#### **Tool (I): Virtual classes' knowledge questionnaire:**

A structured questionnaire was developed by the researchers, it consisted of three parts:

**Part (1):** Personal data of the studied intern nurses included; age, gender, marital status, residence place, and attended previous courses about medication safety.

**Part (2):** Computer experience of intern nurses including 6 items as level of computer knowledge and attended previous courses in computer practices.

**Part (3):** Knowledge regarding virtual classes about medication safety consisting of 80 questions to assess intern nurses' knowledge regarding virtual classes about medication safety, in the form of multiple-choice, and true or false questions.

#### **Scoring system**

The studied intern nurses' answers were compared with a model key answer and scored as; "1" for corrects and "zero" for incorrect, so the total scores are 80 and cut off point done at 60% that equals 48 points. In this respect, the level of intern nurses' knowledge was categorized as the following: Good knowledge level  $\geq 75\%$  that equals  $\geq 60$  points, average level from 60 to less than 75% that equals 48-60 points and poor knowledge level if the percent score  $< 60\%$  that equals  $< 48$  points.

#### **Tool (II): Attitude toward virtual classes questionnaire:**

This tool was developed by the researchers to determine intern-nurses' attitude toward virtual classes. It consisted of 41 items categorized under four domains namely, concepts toward using virtual classes (17 items), perceived usefulness of virtual classes (12 items), organizing and processing information (7 items) and virtual classes and learning environment (5 items).

#### **Scoring system**

Intern nurses' responses were rated on a three-point Likert Scale as follows: always (3), sometimes (2), and never (1). Range of scores is 41:123. Each intern nurse had chosen one best answer after reading carefully and understanding. Finally, the answer was

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assigned numerical values. The intern nurses' attitude toward virtual classes was categorized as the following: Positive attitude  $\geq 75\%$  that equals  $\geq 92$  points and negative attitude  $< 75\%$  that equals  $< 92$  points.

### **Tool (III): Observational checklist for safety measures regarding medication administration:**

A structured self-administrated questionnaire was developed by the researchers to assess intern nurses' practice of safety measures regarding medication administration. It consisted of 60 items categorized under three main dimensions as the following; the first dimension is pre medication administration (30 items) which divided under five sub dimensions namely performs hand hygiene (2 items), the second sub dimension is identifying patient correctly (8 items), the third sub dimension is medication rights and check (10 items), the fourth sub dimension is check medication order (6 items) and fifth sub dimension is visually inspection (4 items), the second main dimension is during medication administration (17 items) and the third main dimension is post medication administration (13 items).

### **Scoring system**

Intern nurses' practice was evaluated by using a three-point Likert scale as follows: (2) completely done, (1) incompletely done and (zero) not done. The scores of the items were summed-up and the total divided by the number of the items, giving a mean score for the part. These scores were converted into a percentage score. The range of scores is from 0:120. The practice was considered high if  $\geq 75\%$  that equals  $\geq 90$  points, moderate practice level from 60% to less than 75% that equals 72 -  $< 90$  points and low practice level  $< 60\%$  that equals  $< 72$  points.

### **Tool (IV): Virtual classes:**

The researchers designed and implemented the virtual classes about medication safety among intern nurses. It included eight sessions

and each session lasted from 1:1.30 hour and Virtual classes were implemented by using Google classroom, Zoom education and Schoology. The electronic form was used to evaluate the intern nurses to achieve the virtual classes.

### **Validity of the tools**

The study tools were revised and ascertained by seven Experts from different nursing Faculties; in the field of Nursing Administration and Nursing Education (one Professor and three Assistant Professors from Cairo University) and (one Professor and two Assistant Professors from Ain Shams University).

The validity of the tools aimed to judge its clarity, comprehensiveness, relevance, simplicity, and accuracy. Based on the experts' perspective, minor modifications were done based on their comments such as (separation the questions of virtual classes from questions of medication safety) and the researchers developed the final validated form of the tools. This phase took one month, January 2021.

### **Reliability of tools**

Reliability of the tools was examined by using Cronbach's Alpha Coefficient test to measure the internal consistency for all tools; Virtual classes' knowledge was 0.98 distributed as, virtual classes knowledge 0.96 and medication safety knowledge 0.96, Attitude toward virtual classes was 0.88, and observational checklist for safety measures regarding medication administration was 0.90, that reflect accepted intern nurse consistency of the tools.

### **Ethical consideration**

The study was conducted with careful attention to ethical standards of research and rights of the participants/ intern nurses: Before conducting the study, the researchers explained the nature and aim of the study to the intern nurses and informed them that participation in the study was voluntary. Oral consent was



obtained from each intern nurse in the study. Confidentiality of data obtained was protected by allocating a code number to the questionnaire. Intern nurses were informed that the obtained data would be used for research purposes only and have the right to withdraw from the study at any time with no consequences ascertained.

#### **Pilot study**

was carried out on six intern nurses who represent 10% of the subjects at the previously mentioned setting to test the applicability and clarity of the constructed tools; it also served to estimate the time needed to fill data collection tools and to identify obstacles and problems that may be encountered during data collection. No modification was made, and pilot study intern nurses were included in the main study subjects. It was done in February 2021.

#### **Field Work**

The following phases were adopted to achieve the aim of the current study: assessment, planning, implementation, and evaluation phases. These phases took eight months, from March 2021 to October 2021.

#### **Assessment phase**

This phase involved meeting the intern nurses, the researchers went to the previously mentioned settings three days weekly (Monday, Wednesday and Thursday) from 9:00 am to 7:00 pm in each study setting. In the beginning the researchers introduced her-self and welcomed the study subjects and gave a brief idea about the aim of the study and the method of implementing virtual classes for all intern nurses after selecting the sample randomly, explained the method of filling out the questionnaire online, “virtual classes knowledge questionnaire and attitude toward virtual classes questionnaire”.

#### **Planning phase**

Based on baseline data obtained from pretest assessment and relevant literature review, the virtual classes were developed by

the researchers. This phase took two months from April to May 2021. The researchers designed virtual classes also constructed in the form of handout and given to intern nurses.

#### **Implementation Phase**

The implementation phase was achieved through the researchers observed intern nurses' performance during their working hours, intern nurses were observed when giving medication for several patients by several routes and the researchers distributed educational booklet to them on the first day of implementation phase. Also the implementation phase was achieved through sessions online, at June 2021. The researchers divided the studied intern nurses into 3 groups, each group composed of twenty intern nurses. Virtual classes' handout distributed to participants on the first day of virtual classes' implementation. The virtual classes has taken 8-12 hr. for each group distributed as eight online sessions. Each session lasted 1:1.30 hr. and was implemented according to intern nurses desire and time available.

#### **Evaluation phase**

After virtual classes' implementation, the posttest was carried out immediately after the intervention done, also after three months (follow-up). This helped to evaluate the effect of applying virtual classes on intern nurses' knowledge and attitude toward virtual classes' (online tests) and practice of medication safety (observational checklist by researchers), by using the same tools of pre- test. The time of data collection lasted for four months from July to October 2021.

#### **Ethical consideration**

Data was verified prior to computerized entry. The Statistical Package for Social Sciences (SPSS version 26.0) was used for that purpose, followed by data analysis and tabulation. Descriptive statistics were applied quantitative data (eg. mean, standard deviation, frequency and percentages). ( $\chi^2$ ) test and fisher

exact test was utilized to compare percentage between studied variables. Paired t test was used to compare mean scores between pre and post program. Pearson correlation (r) test was used for association between variables. Non-significant level value was considered when  $P > 0.05$  and a significant level value was considered when  $p \leq 0.05$  and a highly significant level value were considered when  $p \leq 0.001$ . The standard deviation: as a measure of dispersion of results around the mean (for quantitative variable).

### **Results**

**Table (1):** Indicates that, two fifths (40.0%) of the intern nurses were aged from 22 to less than 23 years old, with mean score  $22.28 \pm 0.88$  and slightly less than two thirds (63.3%) of them were female. As far as marital status the most (81.7%) of intern nurses had unmarried and nearly three fifths (58.3% & 61.7%) of them from urban area and attended previous courses about medication safety respectively.

**Figure (1):** Clarifies that, the most (81.7%) of intern nurses' had poor knowledge related to virtual classes and medication safety dimensions at pre- intervention phase, while it improved to be the majority (80.0%) of them had good knowledge at immediately post intervention phase with slightly decreased to be less than three quarters (71.7%) at follow-up phase.

**Table (2):** Presents that, there was highly statistically significant improvement of intern nurses' knowledge scores regarding virtual classes and medication safety at immediately post and follow-up intervention phases, the highest total mean score of intern nurses' knowledge at immediately post was  $8.55 \pm 0.53$  with mean percent 95.0% and at follow-up intervention phases  $7.83 \pm 0.58$  with mean percent 78.3% was related to the ways to use virtual classes compared to pre-intervention

phase was  $2.10 \pm 1.21$  with mean percent 23.3%. While the lowest total means score of intern nurses' knowledge at immediately post was  $9.13 \pm 0.50$  with mean percent 91.3% and at follow-up phase  $6.71 \pm 1.16$  with mean percent 67.1% was related to medication errors compared with pre intervention phase was  $2.201 \pm 0.91$  with mean percent 22.0 %.

**Figure (2):** Reveals that, the majority (88.3%) of intern nurses' had negative attitude toward virtual classes at pre-intervention phase, while it improved to be majority (93.3% and 83.3%) of them had positive attitude respectively at immediately post and follow-up intervention phases.

**Table (3):** Indicates that, there was highly statistically significant improvement of intern nurses' attitude scores toward virtual classes at immediately post and follow-up intervention phases; the highest total mean scores of intern nurses' attitude at immediately post and follow-up intervention phase was  $35.16 \pm 0.66$  and  $31.91 \pm 1.16$  with mean percent 97.6% and 88.6% respectively was related to perceived usefulness of virtual classes domain compared to pre-intervention phase was  $14.78 \pm 1.09$  with mean percent 41.1%. While, the lowest total mean scores of intern nurses' attitude at immediately post and follow-up phase was  $20.18 \pm 0.70$  and  $18.21 \pm 0.99$  with mean percent 96.1% and 86.7% respectively was related to organizing and processing information domain compared with pre-intervention phase was  $8.86 \pm 0.91$  with mean percent 42.2%.

**Figure (3):** Clarifies that, the majority (85.0 %) of intern nurses had low practice level regarding medication administration safety at pre- intervention phase, while it improved to be the majority (88.3 %) of them had high practice level at immediately post intervention phase, with slightly decreased to be more than three-quarters (76.7 %) of them had high practice level regarding medication administration safety at follow-up intervention-phases.

**Table (4):** Indicates that, there was highly statistically significant improvement of intern nurses’ mean scores regarding medication administration safety practice at immediately post and follow-up intervention phases; the highest total mean scores of intern nurses’ practice dimensions at immediately post and follow-up phases was  $25.13 \pm 0.59$  and  $22.38 \pm 1.40$  with mean percent 96.6% and 86.0% respectively was related to post medication administration safety procedure dimension compared with pre-intervention phase was  $1.85 \pm 0.75$  with mean percent 7.1% . While the lowest total means scores of intern nurses’ practice at immediately posts and follow-up phases was  $57.83 \pm 0.80$  and

$50.08 \pm 3.13$  with mean percent 96.4% and 83.5% respectively was related to pre-medication administration safety procedure dimension compared with pre-intervention phase was  $10.46 \pm 2.02$  with mean percent 17.4%.

**Table (5):** Illustrates that, there was a positive highly statistically significant correlation between total knowledge, attitude toward virtual classes and practice of medication safety at immediately post phase and there was statistically significant correlation at follow-up phase. While there was no statistically significant correlation at pre-intervention phase.

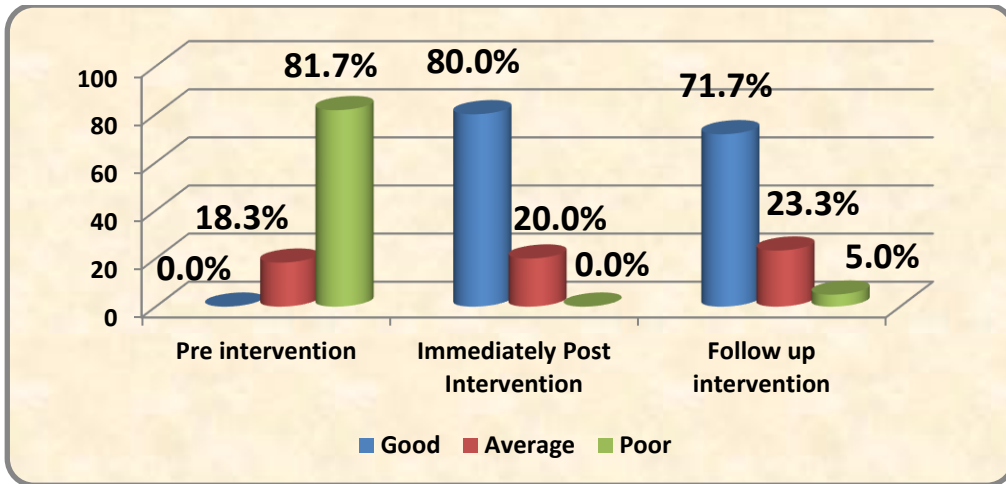
**Table (1): Distribution of the studied intern nurses’ regarding their personal data (n=60)**

Personal data		No.	%
Age ( years)	21- < 22	12	20.0
	22- < 23	24	<b>40.0</b>
	23- < 24	19	31.7
	≥ 24	5	8.3
<b>Range</b>		<b>21-24</b>	
<b>Mean ± SD</b>		<b>22.28±0.88</b>	
Gender	Male	22	36.7
	Female	38	<b>63.3</b>
Marital status	Married	11	18.3
	Unmarried	49	<b>81.7</b>
Residence place	Urban	35	<b>58.3</b>
	Rural	25	41.7
Attended previous courses about medication safety	Yes	23	38.3
	No	37	<b>61.7</b>

**SD= standard deviation**



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**Figure (1): Intern nurses’ overall virtual classes’ and medication safety knowledge levels thorough the intervention phases (n=60)**

**Table (2): Mean scores of intern nurses’ virtual classes and medication safety knowledge dimensions at pre, immediately post and three- months later intervention implementation (n=60)**

Total knowledge dimensions	Maximu	Pre- Intervention phase		Immediately post - Intervention Phase		Follow-up Intervention phase		paired t1	P- value	paired t2	P - value
		X±SD	Mean%	X±SD	Mean%	X±SD	Mean%				
Overview about virtual classes	12	2.66±0.95	22.2	11.33±0.65	94.4	9.21±0.66	76.8	59.410	0.000**	40.444	0.000**
Tools of virtual classes	9	2.05±0.62	22.7	8.41±0.53	93.5	6.91±0.64	76.8	59.944	0.000**	39.799	0.000**
Types of virtual classes	10	2.16±1.18	21.6	9.45±0.53	94.5	7.03±0.63	78.1	45.632	0.000**	30.116	0.000**
The ways to use a virtual classroom	9	2.10±1.21	23.3	8.55±0.53	95.0	7.83±0.58	78.3	38.214	0.000**	28.545	0.000**
<b>Total virtual classes knowledge</b>	40	8.98±2.18	22.4	37.75±2.91	94.3	31.00±1.02	77.5	94.399	0.000**	68.756	0.000**
Patient safety and medication safety	10	2.30±0.82	23.0	9.41±0.63	94.1	7.71±1.16	77.1	56.490	0.000**	30.928	0.000**
Rights of medication administration	7	1.50±0.83	21.4	6.48±0.50	92.6	5.41±0.96	77.3	37.360	0.000**	25.338	0.000**
Medication use process	13	3.03±1.02	23.3	12.18±0.62	93.7	10.20±0.83	78.4	56.866	0.000**	40.231	0.000**
Medication errors	10	2.20±0.91	22.0	9.13±0.50	91.3	6.71±0.71	67.1	50.124	0.000**	38.421	0.000**
<b>Total medication safety knowledge</b>	40	9.03±2.25	22.5	37.21±0.80	93.1	30.03±1.81	75.1	95.706	0.000**	60.105	0.000**
<b>Total knowledge</b>	80	17.83±3.67		74.96±1.36		62.05±2.47		117.926	0.000**	72.024	0.000**

(\* A statistical significant difference  $P \leq 0.05$  \*\*, A highly statistical significant difference  $P \leq 0.001$ )

t-test & P Value (1): between Pre-Intervention and Post Intervention

t-test & P Value (2): between Pre Intervention and Follow-up Intervention

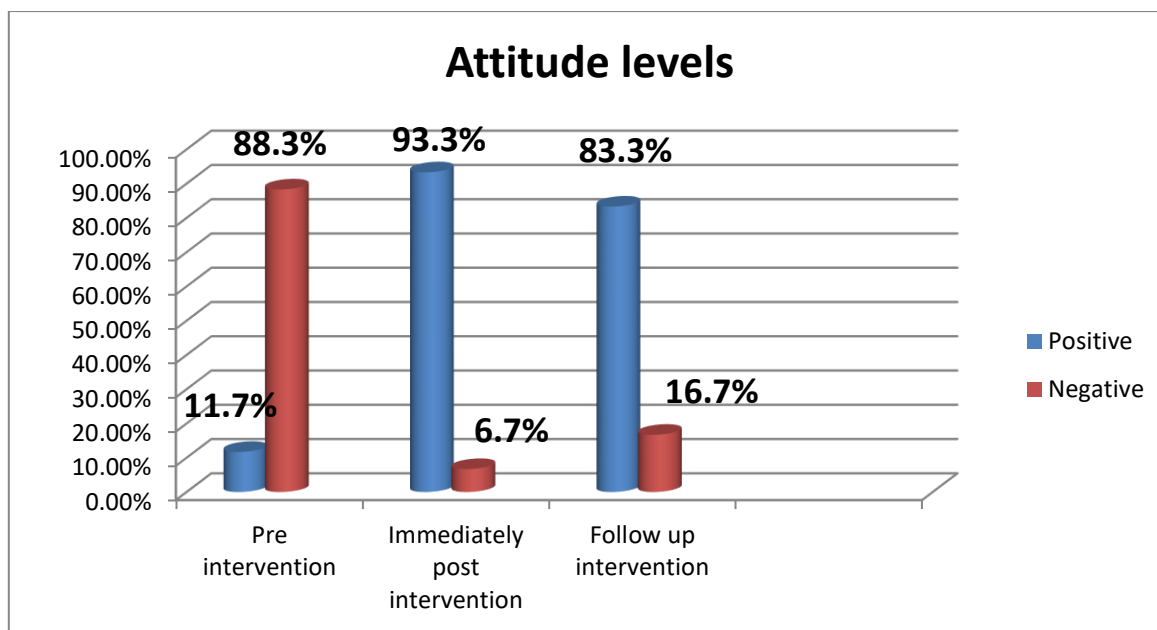


Figure (2): Intern-nurses’ overall attitude levels toward virtual classes’ through the intervention phases

Table (3): Mean scores of intern nurses’ total attitude toward virtual classes at pre, immediately post and follows up intervention phases (n=60)

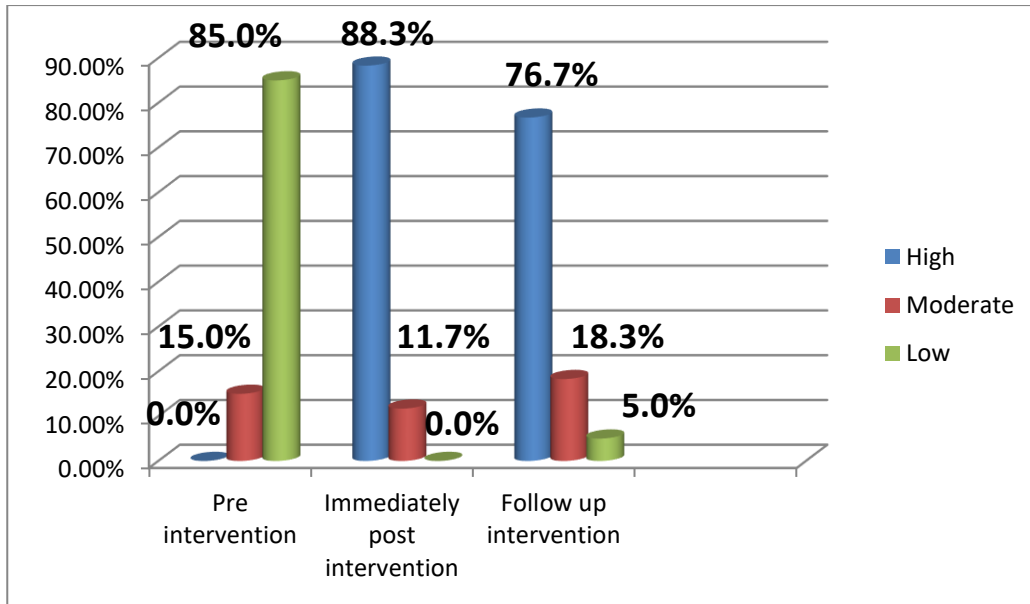
Total attitude domain	Maximum Score	Pre- intervention phase		Immediately post - intervention Phase		Follow- up intervention phase		paired t1	P- value	paired t2	P - value
		X±SD	Mean%	X±SD	Mean%	X±SD	Mean%				
Concepts and benefits of using virtual classes	51	21.53±1.24	42.2	49.38±1.16	96.8	45.11±1.77	88.4	120.963	0.000**	82.362	0.000**
Perceived usefulness of virtual classes	36	14.78±1.09	41.1	35.16±0.66	97.6	31.91±1.16	88.6	138.946	0.000**	80.860	0.000**
Organizing and processing information	21	8.86±0.91	42.2	20.18±0.70	96.1	18.21±0.99	86.7	81.068	0.000**	55.727	0.000**
Virtual classes and learning environment	15	6.26±0.75	41.7	14.63±0.48	97.5	13.25±0.94	88.3	69.077	0.000**	48.448	0.000**
<b>Total attitude</b>	123	51.45±2.15	41.8	119.36±1.604	97.1	108.48±3.203	88.2	188.699	0.000**	137.793	0.000**

(\* A statistical significant difference  $P \leq 0.05$  \*\*, A highly statistical significant difference  $P \leq 0.001$ )

t-test & P Value (1): between Pre-Intervention and Post Intervention

t-test & P Value (2): between Pre Intervention and Follow-up Intervention

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**Figure (3): Intern nurses' overall practice levels regarding medication administration safety at pre, immediately post and follow-up intervention phases (n=60)**

**Table (4): Mean scores of the studied intern nurses' practice regarding medication administration safety dimensions at pre, immediately post and follow-up intervention phases (n=60)**

Total practice dimensions	Maximum	Pre- Intervention phase		Immediately Post- Intervention Phase		Follow- up Intervention phase		paired t1	P- value	paired t2	P - value
		X±SD	Mean%	X±SD	Mean%	X±SD	Mean%				
Pre-medication administration procedure	60	10.46±2.02	17.4	57.83±0.80	96.4	50.08±3.13	83.5	167.250	0.000**	97.975	0.000**
During medication administration procedure	34	8.13±1.50	23.9	32.80±0.70	96.5	28.40±2.00	83.5	103.432	0.000**	72.882	0.000**
Post medication administration safety procedure	26	1.85±0.75	7.1	25.13±0.59	96.6	22.38±1.40	86.0	123.847	0.000**	98.601	0.000**
<b>Total practice</b>	120	20.45±3.05	17.1	115.76±1.29	96.4	100.86±5.14	84.0	218.935	0.000**	116.380	0.000**

(\* A statistical significant difference  $P \leq 0.05$  \*\*, A highly statistical significant difference  $P \leq 0.001$ )

/ t-test & P Value (1): between Pre-Intervention and Post Intervention

/ t-test & P Value (2): between Pre Intervention and Follow-up Intervention

**Table (5): Correlation matrix among intern nurses’ total knowledge, attitude toward virtual classes and practice of medication safety thorough the intervention phases (n= 60)**

Phases	Variables		knowledge (virtual classes and medication safety)	attitude toward virtual classes	medication safety practice
Pre-intervention	knowledge(virtual classes and medication safety)	r		.127	.079
		P-value		.334	.559
	attitude toward virtual classes	r	.127		.080
		P-value	.334		.389
	medication safety practice	r	.079	.080	
		P-value	.559	.389	
Immediately post intervention	knowledge(virtual classes and medication safety)	r		.369	.932
		P-value		.004**	.000**
	attitude toward virtual classes	r	.369		.880
		P-value	.004**		.000**
	medication safety practice	r	.932	.880	
		P-value	.000**	.000**	
Follow-up intervention	knowledge(virtual classes and medication safety)	r		.350	.300
		P-value		0.006**	.020*
	attitude toward virtual classes	r	.350		.319
		P-value	0.006**		.013*
	medication safety practice	r	.300	.319	
		P-value	.020*	.013*	

(\* A statistical significant difference  $P \leq 0.05$  \*\*, A highly statistical significant difference  $P \leq 0.001$ )

**Discussion**

A Virtual classroom “means a teacher-led remote learning environment conducted in real time using video conferencing technology to deliver a broad array of solutions that enhance knowledge and performance and in which students are taught the standards and guidelines of patient safety and medication safety. Medication safety, is the freedom from accidental injury due to medical care or medical errors during the medication-use process, deserves the same prioritization, given the scope of medication use in patient care and the frequency and severity of

potential harm (Despins & Cawiezell, 2020; WHO, 2022).

The current study clarified that, the most of intern nurses had poor knowledge related virtual classes and medication safety dimensions at pre-intervention phase. While it improved to be majority of them had good knowledge at immediately post intervention phase, with slightly decreased to be less than three-quarters at follow-up intervention phases.

From the researchers’s point of view, this result might be due to inadequacy of intern nurses' knowledge regarding virtual classes’ about medication safety and the most of them

didn't attend previous training program about medication safety. After applying effective virtual classes thorough using interaction teaching methods' additionally using online quizzes before and after each session and interesting in intern nurses feedback in each session and the discussion between instructor and intern nurses lead to improvement of their knowledge regarding virtual classes' and medication safety .

The finding of the present study is supported by **Kim et al., (2021)**, pointed that there was a significant increase in knowledge about online learning and learning flow and self-regulation from the pre-test to the post-test. Also this finding is supported by **Sharma& Arora, (2021)** who study indicated that there was a significant improvement in nurses' knowledge about online learning after attended the online classes' intervention. Also parallel with **Soon et al., (2022)** who pointed that, the two thirds of nurses reported incorrect answer related to medication safety knowledge at pre-program. While, it improved to the most of them reported correct answer after program implementation .

Regarding mean scores of intern nurses virtual classes' and medication safety knowledge dimensions thorough the intervention phases the finding of the current study revealed that, the highest total mean score of intern nurses' knowledge at immediately post and at follow-up phases was related to the ways to use virtual classes compared with pre- intervention phase. While the lowest total means score of intern nurses' knowledge at immediately post and at follow-up phase compared to pre-intervention phase was related to medication errors .

This may be due to the application of virtual classroom sessions during the Covid delinquency period, as the orientation of the whole country was through the Internet and video conference online, whether in

education, personal communication or all transactions, which is a transitional period between traditional classes and virtual classes. Moreover all sample have advanced mobile phone connected with internet all times and used it instead of computers. Also nearly three fifths of intern nurses didn't attended previous courses about medication safety.

This result is supported with **claudiu et al., (2020)** who found that increasing technology awareness and an attitude toward e-learning, enhancing basic technology knowledge. As well as, **Achmed et al., (2021)** found that, lack of training and assistance in using online learning were identified as the most frequent barriers encountered by nursing students.

Concerning intern nurses' attitude levels toward virtual classes' thorough the intervention phase. The result revealed that, the majority of intern nurses had negative attitude toward virtual classes' at pre-intervention phase. While it improved to be the majority of them had positive attitude at immediately post intervention phases, with slightly decreased to be the most of them had positive attitude at follow-up intervention phase.

The result matches with **Ismael, (2017)** who found that the highest percent of intern nurses had positive attitude toward online learning after program implementation. In addition, the highly satisfactory at immediately post program implementation and follow-up phases. While the finding disagreement with, **Obaid et al., (2019) and Cakiroglu (2021)** who pointed that there was negative attitude among students regarding online learning and showed lack students' interest in using online learning, the most of students had least understanding about online learning.



The present study showed that the highest total mean scores of interns nurses' attitude at immediately post and follow-up intervention phases were related to perceived usefulness of virtual classes' domain. While the lowest total mean scores were related to organizing and processing information domain compared with pre-intervention phase.

This result is in accordance with **Al-Qahtani (2019)** they pointed that the majority of respondents realize that virtual classes facilitate their learning and teaching process in the same manner when compared to face-to-face classes and do not cause difficulties that may handicap the educational process. Eighteen participants agree that there is no difference between virtual classes and face-to-face classes in facilitating the process of learning and teaching. Similarly study done by **Parker & Martin (2022)** whose study showed that the students' achievement was better and scored higher than face-to-face classroom as the geographical barriers are removed and able to manipulate learning objects actively. Even though there are good responses on the online learning method, communication technologies are expected from the students to get timely responses in educational needs.

On the other hand **Cakiroglu (2021)** who reported that virtual classroom are one of the main components of synchronous settings that share certain similarities with real classrooms, it is negatively affected the lesson time and caused occasional limitations and influence the time management of the course specially when the line is busy.

Concerning intern nurses' practice levels regarding medication administration safety thorough intervention phase, the finding of the current study clarified that; the majority of intern nurses' had low practice level regarding medication administration safety at pre- intervention phase, while it improved to

be the majority of them had high practice level at immediately post intervention phase, with slightly decreased to be more than three quarters of them had high practice level regarding medication administration safety at follow-up intervention-phases.

In the researchers point of view this might be due to, the hospitals and intern nurses didn't attend training programs about medication safety, but when the researchers conducted virtual classes about medication safety for intern nurses using different teaching techniques as educational video which helped in improving their practice regarding medication administration.

The present finding showed that the highest total mean scores of intern nurses' practice dimensions at immediate post and follow-up phases was related to post medication administration safety procedure dimension compared with pre-intervention phase. While the lowest total means scores was related to pre-medication administration safety procedure dimension compared with pre-intervention phase.

This finding was supported by **Mosa, (2016) and Rizk, (2021)** who showed that nurses' performance levels about safety measures related to medication administration, where poor performances at pre- program in all skills regarding three stages, including pre, during and post administration of medication, and improved to be the most of them had high practice level at post and later three months program phases. Also this result is in accordance with the study done by **Ahmed et al., (2021)** which showed that the most of interns had low performance regarding the medication administration safety at pre phase, and significantly improved at immediately post and follow-up phases.

Concerning correlation matrix among intern nurses' total knowledge regarding

virtual classes and medication safety, attitude toward virtual classes and practice of medication safety, the finding of the present study revealed that there was a positive statistically significant correlation between total knowledge, attitude toward virtual classes and practice of medication safety at immediately post and follow-up intervention phase. While there was no statistically significant correlation at pre- intervention phase.

This finding is highly supported with **Ismael, (2017)** who reported that there was highly positive statistically correlation between nurses interns attitude towards online learning and their knowledge in the pre-program implementation phase and positive statistically correlation between nurses interns attitude towards online learning and their technological skills for using online learning at immediately post program implementation and follow-up phases.

Also **Alfadda& Mahdi (2021)** indicated that there was no correlation between the gender and any variables of the model and found that experience is positively correlated with the variables of technology acceptance model and strong positive correlation between the actual use of Zoom and the students' attitudes and behavioral intention and there was a positive correlation between computer self-efficacy and other variables (i.e. Perceived Usefulness (PU), activities, Perceived Ease of Use (PEU), attitude and behavioral intention).

Also **Rashed, (2021)** who showed that; there was positively correlated between nurses' interns' technological attitude for using the online learning and internet connection and speed at immediately post program implementation. Additionally, there was no statistically significant correlation between the personal characteristics of nurses' interns and their evaluation of the

online educational program at immediate post program implementation and follow-up phase.

### **Conclusion**

There was a highly statistically significant improvement of intern nurses' knowledge, attitude toward virtual classes and practice of medication safety between pre and immediately post intervention phases and pre and follow-up intervention phases.

There was a positive statistically significant correlation between intern nurses 'total knowledge, attitude toward virtual classes and practice of medication safety at immediate post and follow-up intervention phase. While there was no statistically significant correlation at pre- intervention phase.

### **Recommendations**

#### **For faculty:**

- Conducting training course and workshops periodically for intern nurses about virtual classes for improving their attitude and perceptions regarding virtual classes for improving their knowledge and practices.
- Evaluating virtual classes implementation process and using to assess the obstacles in its implementation and put different strategies for solving it
- Designing training program for intern nurses about virtual classes to increase the effectiveness in using virtual classroom.
- Developing virtual classes' guidelines including attending, interaction and assessment tools and publishing it for intern nurses to facilitate the use of it.
- Designing online courses for intern nurses regarding medication safety by using different features of virtual classes.
- Using different teaching methods on virtual classroom to gain intern nurses attention and increase interaction during courses.

- Providing feedback about intern nurses assignments and encouraging effective communication in virtual classes.

#### **For hospital administration:**

- Conducting training courses and workshops periodically for intern nurses about medication safety especially at critical care units to improve quality of care and patient safety.
- Preparing a booklet on the hospital's safety policies regarding medication safety and distributing it to all hospital departments explaining the role of the medical team in implementing these policies.

#### **For further research**

- Reapplication of the study on a longer probability sample and different setting is recommended to achieve generalizable results.
- Examine the effect of virtual classroom utilization on intern nurses critical thinking and creativity.
- Investigate the relationship between perceived and usability, personality traits and learning gain in virtual classroom.

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## تصميم و استخدام الفصول الافتراضية عن سلامة الدواء لتمرير الامتياز

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تسمح بيئة التعلم الافتراضية لتمرير الامتياز بالمشاركة في التعليم والتي تمكن من اكتساب المهارات النظرية والعملية فيما يتعلق بسلامة الأدوية دون قيود الزمان والمكان. لذا هدفت الدراسة إلى تصميم وتنفيذ فصول افتراضية حول السلامة الدوائية بين تمرير الامتياز. و تم استخدام تصميم شبه تجريبي. حيث أجريت الدراسة في مناطق التدريب الإكلينيكي لتمرير الامتياز في مستشفى جامعة بنها. وتتألف من 60 ممرضة/ ممرض الامتياز في الفترة من 2020-2021. وأظهرت نتائج الدراسة أن معظم تمرير الامتياز لديهم معرفة ضعيفة فيما يتعلق بالفصول الافتراضية وأبعاد سلامة الدواء في مرحلة ما قبل التدخل ، والتي تحسنت لتكون لدى معظمهم معرفة جيدة في مرحلة ما بعد التدخل مع انخفاض طفيف ليكون في مراحل المتابعة. كان الغالبية لتمرير الامتياز موقف سلبي تجاه الفصول الافتراضية في مرحلة ما قبل التدخل ، والتي تحسنت لتصبح غالبية تمرير الامتياز يتمتعوا بموقف إيجابي على التوالي في مرحلتي ما بعد والمتابعة. كانت غالبية تمرير الامتياز يتمتعوا بمستوى ممارسة منخفض في مرحلة ما قبل التدخل ، في حين أنه تحسن لأن الغالبية منهم يتمتعوا بمستوى عالٍ من الممارسة في المرحلة اللاحقة ، مع انخفاض طفيف إلى أن ثلاثة أرباعهم يتمتعوا بمستوى عالٍ من الممارسة فيما يتعلق بسلامة إدارة الدواء في متابعة مراحل التدخل. كما أدى تطبيق فصول افتراضية حول سلامة الأدوية إلى تحسن كبير إحصائيًا في معرفة تمرير الامتياز ، والموقف تجاه الفصول الافتراضية وممارسة سلامة الأدوية. وأوصت الدراسة بتقييم عملية تنفيذ الفصول الافتراضية بالكلية وتقدير معوقات تنفيذ الفصول الافتراضية ووضع استراتيجيات مختلفة لحلها.