



# “A study to assess the effectiveness of Virtual Teaching Program (VTP) regarding care of central venous catheter in terms of knowledge and skills among Nursing Students in selected Nursing Colleges of North India”

**AUTHOR:** Kuldeep Singh (M.Sc. Nursing) Department of Medical Surgical Nursing, Maharishi Markandeshwar College of Nursing, Maharishi Markandeshwar (deemed to be university), Mullana, Ambala, Haryana, India.

**CO-AUTHOR 1:** Dr Kanika Rai (Ph.d Nursing), Professor & HOD of Medical Surgical Nursing Department, Maharishi Markandeshwar College of Nursing, Maharishi Markandeshwar (deemed to be university), Mullana, Ambala, Haryana, India.

**CO-AUTHOR 2:** Mrs. Uma Deaver (Professor & HOD of Community Health Nursing Department, Maharishi Markandeshwar College of Nursing, Maharishi Markandeshwar (deemed to be university), Mullana, Ambala, Haryana, India.

**Address for Correspondence:** Mr. Kuldeep Singh Maharishi Markandeshwar College of Nursing, Maharishi Markandeshwar (deemed to be university) Mullana, Ambala, Haryana, India  
E-mail: [sinhmarshab55@gmail.com](mailto:sinhmarshab55@gmail.com)

## Abstract

**Context:** In today 's Globally, approximately 8 percent of hospitalized patients require central venous Catheter (CVC). Reports says CVC's have a higher infection risk than any other indwelling vascular access lines. Nurses are responsible for the care of central venous catheter and they must be instructed and prepared for this responsibility. Educational programs are the key pillar of prevention of CVCs Complications.

**Aims:** The present study aims to assess the knowledge and skills before and after administration of virtual teaching program (VTP) regarding care of central venous catheter among nursing students in VT group and Conventional teaching in CT group.

**Setting and Design:** A quasi-Experimental Non-Equivalent control group pre-test post-test design was conducted among a purposive sample of 130 nursing students (65 in VT group and 65 in CT group) in selected Nursing Colleges of North India.

**Material and Methods:** Data were collected using Selected demographic variables, Structured knowledge questionnaire and Structured Observational Checklist were used to collect data. Virtual teaching program was administered in VT group and Conventional teaching in CT group.

**Statistical Analysis Used:** SPSS version 20 was used for descriptive and inferential for data analysis.

**Results:** Parametric tests were used for the analysis. There was statistically weak positive correlation was found between knowledge and skills in post-test among nursing students in VT group. There was no association of pre-test knowledge score of nursing students in VT group and CT group with their selected variables expect name of college in VT group and attend any classroom lecture/ workshop/ seminar/ conference on care of CVC, completed clinical posting, emergency in CT group. In the pre-test skills score there was no significant association of nursing students in VT group and CT group with their selected variables

**Conclusion:** The findings concluded that Virtual Teaching Program (VTP) was effective in enhancing the knowledge and improving skills regarding care of central venous catheter among nursing students. Conventional Teaching was effective in enhancing the skills regarding care of central venous catheter among nursing students. But Virtual Teaching Program (VTP) was more effective than Conventional Teaching in enhancing skills regarding care of central venous catheter among nursing students.

**Keywords:** Effectiveness, Virtual Teaching Program, Knowledge, Skills, Care of central venous catheter and Nursing students.

### Key Message

Participation in a virtual teaching program (VTP) can promote Virtual Teaching Program (VTP) regarding care of central venous catheter in terms of knowledge and skills among Nursing Students.

**Introduction** National Healthcare Safety Network (NHSN) defines “Central line (CL) as an intravascular catheter that terminates at or close to the heart, or in one of the great vessels that is used for infusion, withdrawal of blood, or hemodynamic monitoring.<sup>i</sup> Central venous access is a commonly performed procedure. Globally, approximately 8 percent of hospitalized patients requiring central venous access. In U.S more than 5 million central venous catheters (CVCs) are placed each year, with an associated complications rate of more than 15 percent. There are not much data regarding the placement of Central venous catheter (CVC) in any other country or in India.<sup>ii</sup>

Central venous catheters (CVCs) are indispensable in modern-day medical practice, particularly in intensive care units (ICUs). They provide secure access to the central circulation for infusion therapy, nutritional support, hemodynamic monitoring, plasmapheresis, apheresis and hemodialysis.<sup>iii</sup>

Central venous catheterization or catheter insertion have been classified by various ways like the vessels it occupies, site of insertion, duration of use, its path from skin to vessel, material, special coatings, physical length, number of lumens or some special characteristic and uses of catheter.<sup>iv</sup>

Central venous cannulation is indicated as means of vascular access for patients with difficult intravenous access, those requiring multiple attempts for peripheral access, obese patients with difficult peripheral access and patients with other chronic conditions.<sup>v</sup>

Organisations like CDC have provided guidelines on care of CVC.<sup>vi</sup> The guidelines were mainly for training the health personnel which included information on insertion of CVC, maximum barrier precautions while insertion, skin cleaning with 2% alcoholic chlorhexidine three times, change of gauze dressing every 2 days and transparent dressing every 7 days, use of needleless connectors, wiping surface of the needleless device with alcohol for 15–20 s before access, removal of CVC when not needed, closed systems for IV fluids, no stock solutions, use of prefilled flushing syringes, daily bathing of patients with central lines with 4% chlorhexidine-based soap, terminating total parenteral nutrition solutions within 12 h of opening the bag, routine change of administration sets and connectors every 72 h and finally care to transfuse blood products within 30 min of receipt at the bedside.<sup>vii</sup>

### **Need and Justification**

The overall aims of VTP are to improve the knowledge and skills of nursing students regarding care of central venous catheter. Nurses are responsible for the care of central venous catheter and they must be instructed and prepared for this responsibility. In order to prepare them for providing care, it is required to impart education.<sup>viii</sup>

Continuous education and updating knowledge and skills for nurses is very important, because they are working in different shifts, do not have the opportunity to participate in face-to-face teaching sessions; self-educating methods are very useful for them. Online, virtual teaching program has emerged as an alternative means of providing continuing education to nurses. So this study concluded that the knowledge and level of nurses' practice regarding care of central line increased significantly after implementing the virtual teaching.<sup>ix</sup>

Since the available literature highlights that there occurs a significant improvement in knowledge and skills of nursing students. when they undergo virtual teaching program. Thus, the researchers in present study wanted to evaluate the effectiveness of virtual teaching programme regarding care of central venous catheter in terms of knowledge and skills of nursing students in their setting.

The objectives of the study were:

1. To assess and compare knowledge regarding care of central venous catheter among nursing students in virtual teaching group and conventional teaching group.
2. To assess and compare skills regarding care of central venous catheter among nursing students in virtual teaching group and conventional teaching group.
3. To determine relationship between knowledge and skills of nursing students regarding care of central venous catheter among nursing students in virtual teaching group and conventional teaching group.

4. To find out the association of knowledge and skills regarding care of central venous catheter among nursing students with their selected demographic variables in virtual teaching group and conventional teaching group.

### Subjects and Methods:

**Ethical statement:** The ethical consideration for carrying out the study was obtained from institutional ethical committee of MM (deemed to be) University from other member of the committee for conduct the Final study. (Project no: IEC-1844) and CTRI no: REF/2021/04/042443. Formal administrative approval was being obtained from Principal of Maharishi Markandeshwar College of Nursing, Mullana, Ambala, Maharishi Markandeshwar Institute of Nursing, Mullana, Ambala and Maharishi Markandeshwar College of Nursing, Kumarhatti, Solan (H.P) to conduct the final study. Self-introduction and introduction of the topic was given to the participants. Final study was conducted in the month of April 2021. Simple random sampling was used to allocate the nursing students in VT and CT group with the help of random chit system method. One hundred thirty-eight nursing students (69 in VT group and 69 in CT group) were selected by using Purposive sampling technique from three colleges (M.M. College of Nursing, Mullana, M.M. Institute of Nursing, Mullana and M.M. College of Nursing, Kumarhatti, Solan (H.P.) and randomly allocated to VT and CT group.

The tools used for assessment included structured knowledge questionnaire and structured observation checklist to assess the skills of nursing students regarding care of central venous catheter. A structured knowledge questionnaire consisted of 32 knowledge items to assess the knowledge of Nursing Students regarding care of central venous catheter. Structured knowledge questionnaire consists of 32 multiple choice questions. Each item had a single correct answer. Every correct answer was awarded a score of 'one' and every incorrect answer was assigned a score of 'zero'. The maximum possible score 32 and minimum score was zero on the Structured knowledge questionnaire. Structured knowledge questionnaire was administered through google form.

Structured Observation Checklist regarding care of central venous catheter It comprises of 56 items. Seven Observational checklist was prepared to assess the skills performed in each station. The items included different steps regarding care of central venous catheter. The maximum possible score was 112 and minimum possible score was 0. The time limit for each station was 2 minute. The higher score indicated that Nursing students have good skill regarding care of central venous catheter. There are 7 observational Checklist for these stations.

Prior permission was taken from the developers of both the tools for using the tools in the study.

Effectiveness of Virtual Teaching Programme

### COMPONENTS OF VIRTUAL TEACHING PROGRAMME (VTP)

VTP was developed considering the components to be included for improving knowledge and skills regarding care of central venous catheter. It was given to group of nursing students in the VTP group for one day.

The final draft was developed by the investigator keeping in mind simplicity of language, appropriateness, time limit and adequate content coverage. The teaching plan covered the following area:

- Definition, indications, contraindications, types and complications of central venous catheter.

- Tray set-up and Procedure of assisting insertion of CVC.
- Tray set-up and Procedure of care of CVC.
- Procedure of administration/ infusion of medication through central venous catheter.
- Procedure of administration of Total Parental Nutrition (TPN) and blood transfusion through central venous catheter.
- Nursing responsibilities of care central venous catheter.

Live class were prepared for each component and were given to the nursing students in VTP group through the Zoom meeting.

### Data collection

On day one, Pre-test of students regarding Knowledge was assessed by Structured Knowledge Questionnaire and Skills was assessed by Structured Observation Checklist. On day two Intervention Virtual Teaching Program was given in VT group and Conventional Teaching was given to CT group.

On day 15, Post-test of the students was taken and Knowledge was assessed by Structured Knowledge Questionnaire and Skills was assessed by Structured Observation Checklist in VT group and CT group. But at the time of post- test four students were absent from each group. Therefore, the sample was reduced to 65 students in VT Group and 65 students in CT group.

### Statistical Analysis

The collected data were analysed using SPSS version 20.

After checking the normality of data through Kolmogorov- Smirnov test, parametric tests were applied ( $p>0.05$ ). Both descriptive and inferential statistics were used to analyse the data. Range, mean, median and standard deviation were used to describe the data. Comparison between the groups was carried out by one-way ANOVA, t test & Pearson correlation test. For demographic variables, Chi-square test was used.

**Results:** In this study, one hundreds thirty nursing students in VTP and CT groups were surveyed. Most of the study participants in both groups were age group (18-20 yr.), female, were completed clinical posting of emergency, and were partially homogenous.

The calculated 't' value for knowledge score was 4.10, [ t (128) =1.97] which was found to be statistically non-significant at 0.05 level of significance  $p=0.68$  and for skills score was 3.75 t (128) =1.97;  $p=0.00$  which was found to be statistically significant at 0.05 level of significance. The mean post-test knowledge score ( $20.02\pm 0.61$ ) of nursing students in VT group was higher than the mean pre-test knowledge score ( $16.34\pm 650$ ) and the calculated 't' value of 3.84 was found to be statically significant, t (64)=1.99;  $p=0.00$  at 0.05 level of significance. The mean post-test skills score ( $89.83\pm 5.70$ ) of nursing students in VT group was higher than the mean pre-test skills score ( $41.6\pm 8.17$ ) and the calculated 't' value of 38.10 was found to be statically significant, [t (64)=1.99;

p=0.00] at 0.05 level of significance. A weak positive correlation was found between knowledge and skills in post-test among nursing students in VT group. There was no association of pre-test knowledge score of nursing students in VT group and CT group with their selected variables.

**Table-4.1**

**Chi- square showing comparison of VT group and CT group in terms of selected variables of Nursing Students**

Selected variables	VT Group (n = 65) f(%)	CT Group (n=65) F(%)	$\chi^2$	df	N=130 'p' Value
<b>1.Age (in years)</b>					
1.1 18-20	58(89.2)	55(84.6)	2.15	2	0.34 <sup>NS</sup>
1.2 21-23	7(10.8)	8(12.3)			
1.3 24-26		2(3.1)			
<b>2. Name of college</b>					
2.1MMCON, Mullana	56(86.2)	29(44.6)	25.30	2	0.00*
2.2 MMIN, Mullana	5(7.7)	14(21.5)			
2.3 MMCON, Solan	4(6.2)	22(33.8)			
<b>3.Gender</b>					
3.1 Male	20(30.8)	8(12.3)	6.55	1	0.01*
3.2 Female	45(69.2)	57(87.7)			
<b>4. Any previous knowledge related to catheter (CVC)?</b>					
4.1 Yes	37(56.9)	27(41.5)	3.08	1	0.07 <sup>NS</sup>
4.2 No	28(43.1)	38(58.5)			
<b>5. Attended any classroom lecture/ workshop/ seminar/ conference on care of CVC?</b>					
5.1 Yes	14(21.5)	7(10.8)	2.78	1	0.09 <sup>NS</sup>
5.2 No	51(78.5)	58(89.2)			
<b>6.Completed clinical posting, ICU</b>					
6.1 Yes	29(44.6)	23(35.4)	1.15	1	0.28 <sup>NS</sup>
6.2 No	36(55.4)	42(64.6)			
<b>7.Completed clinical posting, emergency</b>					
7.1Yes	17(26.2)	3(4.6)	11.58	1	0.00*
7.2No	48(73.8)	62(95.4)			

\* Significant (p<0.05)  $\chi^2$  0.05 (1) = 3.8415;  $\chi^2$  0.05(2) =5.9915<sup>NS</sup> Not Significant (p>0.05)

**Table 4.7** Shows the comparison of mean post-test of knowledge score of nursing students regarding care of central venous catheter in VT and CT group. In the VT group, mean post-test knowledge score of the nursing students was found to be  $20.02 \pm 4.94$  and  $16.54 \pm 4.70$  in CT group with the mean difference of 0.23 and standard error of mean difference of 0.85. The difference in the mean scores between the VT and CT group was computed by independent 't' test. The calculated 't' value was found to be  $4.10$  ( $t(128) = 1.97$ ;  $p = 0.68$ ) which was non-significant at 0.05 level of significance

**Table 4.7**

**Mean, Mean Difference, Standard Deviation, Standard Error of Mean Difference 't' value and 'p' value of Post-test Knowledge Score of Nursing Students Regarding Care of Central Venous Catheter in VT and CT group**

N = 130						
Group	Mean $\pm$ SD	M <sub>D</sub>	SE <sub>MD</sub>	t	df	p value
				Value		
VT Group (n = 65)	$20.02 \pm 4.94$	0.23	0.85	4.10	128	0.68NS
CT Group (n = 65)	$16.54 \pm 4.71$					
<b>*Significant (p&lt;0.05)</b>		<b>t<sub>0.05</sub> at 128 = 1.97</b>		<b><sup>NS</sup> Not significant(p&gt;0.05)</b>		

**Table 4.15** In the VT group, in mean post-test skills score of the nursing students was found to be  $89.83 \pm 5.70$  and  $84.58 \pm 9.72$  in CT group, with the mean difference was 5.25 and standard error of mean difference was 1.56. The difference in the mean scores between the VT and CT group was computed by independent 't' test. The calculated 't' value was found to be  $3.75$  ( $t(128) = 1.97$ ;  $p = 0.00$ ) which was statistically significant at 0.05 level of significance.

**Table 4.15**

**Mean, Mean Difference, Standard Deviation, Standard Error of Mean Difference, 't' value and 'p' value of Post-test Skills Score of Nursing Students Regarding Care of Central Venous Catheter in VT and CT group**

N=130						
Group	Mean $\pm$ SD	M <sub>D</sub>	SE <sub>MD</sub>	t	df	p value
				value		
VT Group (n = 65)	$89.83 \pm 5.70$	5.25	1.56	3.75	128	0.00*
CT Group (n = 65)	$84.58 \pm 9.72$					
<b>*Significant (p&lt;0.05)</b>		<b>t at 128 = 1.97</b>		<b><sup>NS</sup> Not significant(p&gt;0.05)</b>		

**Table 4.16** The mean post-test skills score ( $89.83 \pm 5.70$ ) of nursing students in VT group was higher than the mean pre-test skills score ( $41.68 \pm 8.17$ ) with mean difference of 48.15 and standard error of mean difference was 1.26. In the CT group the mean post-test skill score ( $84.37 \pm 9.72$ ) was higher than the mean pre-test skill score ( $42.32 \pm 6.67$ ), with mean difference of 42.26 and standard error of mean difference was 10.02. paired 't' test applied to see the significant difference in the mean skills score. In the VTP group the calculated 't' value of 38.10 was found to be statically significant,  $t(64) = 1.99$ ;  $p = 0.00$  at 0.05 level of significance in VT group. In the CT group the calculated 't' value of 34.00 was found to be statistically significant.  $t(64) = 1.99$ ;  $p = 0.00$  at 0.05 level of significance

**Table 4.16**

**Mean, Mean Difference, Standard Deviation, Standard Error of Mean Difference, 't' value and 'p' of Pre-test and Post-test Skills Score of Nursing Students Regarding Care of Central Venous Catheter in VT and CT group**

Group	Mean $\pm$ SD	M <sub>D</sub>	SE <sub>MD</sub>	t Value	df	p value
N=65						
<b>VT Group (n = 65)</b>						
Pre test	41.68 $\pm$ 8.17	48.15	1.26	38.10	64	0.00*
Post test	89.83 $\pm$ 5.70					
<b>CT Group (n = 65)</b>						
Pre test	42.32 $\pm$ 6.67	42.26	10.02	34.00	64	0.00*
Post test	84.58 $\pm$ 9.72					

\*Significant ( $p < 0.05$ ),  $t = I - t I$

t at 64 = 1.99

<sup>NS</sup> Not significant ( $p > 0.05$ )

**Table 4.21** shows the correlation between the mean pre-test and post test score of knowledge and skills of nursing students regarding care of central venous catheter among nursing students in VT group and CT group. The finding showed that there was statistically significant correlation between pre-test and post-test knowledge and skills score in VT group ( $r = 0.12$ ,  $p = 0.36$ ) ( $r = 0.30$ ,  $p = 0.01$ ) and not in CT group ( $r = 0.17$ ,  $p = 0.17$ ), ( $r = 0.17$ ,  $p = 0.17$ ). The finding showed that there was weak negative correlation between pre-test in VT group and pre-test and post-test in CT group but in the post-test in VT group found to be weak positive correlation.

Table 4.21

**Correlation Between the Mean Pre-Test and Post-Test Score of Knowledge and Skills of Nursing Students Regarding Care of Central Venous Catheter in VT and CT group**

Groups		Skills	
		Pre test	Post test
VT group (n=65)	Pre test	0.12 (0.36 <sup>NS</sup> )	
	Post test		0.30 (0.01*)
CT group (n=65)	Pre test	0.17 (0.17 <sup>NS</sup> )	
	Post test		0.17 (0.17 <sup>NS</sup> )

\*Significant (p<0.05)      r (63) =0.231      <sup>NS</sup> Not significant(p>0.05)

## DISCUSSION

The findings of the study were discussed with reference to the results obtained in other related research studies. The purpose of this present study was to assess the effectiveness of Virtual Teaching Program (VTP) regarding care of central venous catheter in terms of knowledge and skills among nursing students in selected Nursing Colleges of North, India.

### Finding related to Sample characteristics of the VT and CT group in terms of selected variables of the study.

In the present study, Majority of them (87.69) in CT group and (69.23%) in VT group were females and maximum of nursing students in VT group (89.23%) and CT group (84.62%) were in the age group of 18-20 years. These finding consistent with study by **Mrs. Kokila. S (2018)** showed that majority 60% were females, aged between 24-28 years and their professional qualification was staff nurses were B.Sc. Nursing.

These findings were consistent with the study conducted by **Binsy Daniel, Nagaraju B, Padmavathi GV , Ali Bolouri , Zothanmawia C and Sahar SH (2013)** which showed frequency (%) age of staff nurses as 17(34%) respectively and most of them female and their professional qualification was staff nurses were B.Sc. Nursing.

These findings were consistent with the study conducted by **Binu Xavier (2013)** which showed frequency (%) age between 21-25 of staff nurses as 41(82%) respectively and most of them female and their professional qualification was staff nurses were B.Sc. Nursing.

**Findings related to effectiveness of Virtual Teaching Program regarding care of central venous catheter in terms of knowledge.**

Virtual Teaching Program is effective in enhancing knowledge and skills of nursing students. In present study the mean knowledge score and standard deviation in the pre-test was  $16.34 \pm 4.817$  in VT group and in CT group, the mean knowledge score and standard deviation among nursing students was  $15.72 \pm 4.81$ .

In present study the mean knowledge score and standard deviation in the post-test was  $20.02 \pm 4.94$  in VT group and in CT group, the mean knowledge score and standard deviation among nursing students was  $16.54 \pm 4.70$ . These finding consistent with the study conducted by **Mrs. Kokila. S (2018)** showed that there is a significant improvement between the pre-test and post-test scores after the intervention. The pre-test, mean knowledge score was 19.83 and post-test mean knowledge score was 22.93.

These finding consistent with another study conducted by **Binsy Daniel, Nagaraju B, Padmavathi GV, Ali Bolouri , Zothanmawia C and Sahar SH (2013)** showed that there is a significant improvement between the pre-test and post-test scores after the intervention. The mean percent of pre-test knowledge score was 67% and post-test knowledge score was 87%.

These finding consistent with another study conducted by **Binu Xavier (2013)** showed that there is a significant improvement between the pre-test and post-test scores after the intervention. The pre-test, mean knowledge score was  $19.5 \pm 4.71$  (48%) and post-test mean knowledge score was  $29.62 \pm 3.21$  (72%).

These finding consistent with another study conducted by **Huda Alwan Khudair and Khalida Mohammed Khadur (2021)** showed that there is a significant improvement between the pre-test and post-test scores after the intervention. The pre-test, mean knowledge score was 5.09 and post-test mean knowledge score was 9.16.

**Findings related to effectiveness of Virtual Teaching Program regarding care of central venous catheter in terms of skills.**

In present study the mean skills score and standard deviation in the pre-test was  $41.68 \pm 8.17$  in VT group and  $42.32 \pm 6.67$  in CT group and then the mean skills score and standard deviation in post-test was  $89.83 \pm 5.70$  in VT group and  $84.58 \pm 9.72$  in CT group among nursing students.

These finding consistent with the study conducted by **Sakshi, Madhavi Verma and Vandana saluja(2019)** showed that there is a significant improvement between the pre-test and post-test scores after the intervention. The pre-test, mean skills score was  $39.17 \pm 2.86$  and post-test mean skills score was  $47.11 \pm 1.87$ ). There was difference between the pre and post test score.

These finding consistent with another study conducted by **Gehan Abd El-Fattah Atia (2017)** showed that there is a significant improvement between the pre-test and post-test scores after the intervention. The pre-test, mean practice score was 18.3% (related to care of CVL), and 45% (related to giving medication) and post-test mean

practice score was 70% (related to care of CVL), and 93.3% (related to giving medication). There was difference between the pre and post test score.

These finding consistent with another study conducted by **Mrs. Kokila. S (2018)** that there is a significant improvement between the pre-test and post-test scores after the intervention. The pre-test, mean, standard deviation skills score was  $12.56 \pm 2.71$  and post-test mean, standard deviation skills score was  $14.6 \pm 2.79$ . There was difference between the pre and post test score.

### **Correlation between Knowledge and Skills Scores of Nursing Students before and after Administration of Virtual Teaching Program in VT and CT group.**

The present study the correlation between knowledge and skills score among nursing students regarding care of central venous catheter. It shows that there was a significant moderate positive correlation between pre-test and post-test knowledge and skills score was ( $r=1.15$ ,  $p= 0.36$ ) ( $r=0.30$ ,  $p= 0.01$ ) in VT group.

These finding were consistent another study conducted by **Rasha S. Almahmouda, Maha A. Alfarhana, Walaa M. Alanazi a, Farah K. Alhamidya, Hanan H. Balkhy b, Majid Alshamrani a,c, Aiman El-Saeda,c, Betule A. Sairafia, Salim A. Bahron** (2012) compare the teaching strategies on teaching insertion of central venous catheter practices of nurses results showed that there was weak positive correlation was found between knowledge and practice ( $0.266$ ,  $p = 0.001$ ).

These finding were consistent another study conducted by **Mrs. Kokila. S (2018)** compare the teaching strategies on teaching CLABSI knowledge and skills of nurses results showed that there was highly positive correlation was found between pre-test knowledge and pre-test skills ( $r=0.59$ ,  $p = 0.00$ ). There was highly positive correlation and a perfect relationship between post-test knowledge score and post-test skill scores, ( $r=0.74$ ,  $p = 0.00$ ).

These finding were consistent another study conducted by **Sakshi, Madhavi Verma and Vandana saluja(2019)** were significant positive correlation between knowledge scores ( $p= <0.001$ ) and Practice scores ( $p= <0.001$ ) of Nursing Personnel regarding CVC Care Bundle.

### **Association of Pre-test Knowledge and Skills Score regarding care of central venous catheter among nursing students with selected variables in VT and CT group.**

In the present study there was no association found knowledge and skills of nursing students with their selected variables in VT group and CT group.

These findings were inconsistent with the study conducted by **Sakshi, Madhavi Verma and Vandana saluja (2019)** were significant positive association between knowledge scores ( $p= <0.001$ ) and Practice scores ( $p= <0.001$ ) of Nursing Personnel regarding CVC Care Bundle with their selected variables.

These finding were consistent another study conducted by **Mrs. Kokila. S (2018)** were statistically significant association with the post-test level of knowledge score scores ( $p= <0.005$ ) regarding CLABSI. There were

statistically significant association with the post-test level of knowledge score scores ( $p = <0.002$ ) regarding CLABSI.

**Conclusion** The findings concluded that Virtual Teaching Program (VTP) was effective in enhancing the knowledge and improving skills regarding care of central venous catheter among nursing students. Conventional Teaching was effective in enhancing the skills regarding care of central venous catheter among nursing students. But Virtual Teaching Program (VTP) was more effective than Conventional Teaching in enhancing skills regarding care of central venous catheter among nursing students.

### Limitations

The researcher was not able to conduct the study in other states of North India because permission was not granted in other states of north India due to increased incidence of COVID-19.

### REFERENCES

- <sup>i</sup> CDC. National Healthcare Safety network (NHSN) Patient Safety Component Manual. Natl Healthc Saf Netw Patient Saf Compon Man [Internet]. 2021;(January):1–39.
- <sup>ii</sup> Javeri Y, Jagathkar G, Dixit S, Chaudhary D, Zirpe KG, Mehta Y, et al. Indian Society of Critical Care Medicine Position Statement for Central Venous Indian Society of Critical Care Medicine Position Statement for Central Venous Catheterization and Management 2020. 2020;(May).
- <sup>iii</sup> Ritzenthaler T, Beraud M, Gobert F, Dailler F. Influence of vascular access devices upon efficiency of therapeutic plasma exchange. *J Clin Apher.* 2019;34(1):33–8.
- <sup>iv</sup> Javeri Y, Jagathkar G, Dixit S, Chaudhary D, Zirpe KG, Mehta Y, et al. Indian society of critical care medicine position statement for central venous catheterization and management 2020. *Indian J Crit Care Med.* 2020; 24:6–30.
- <sup>v</sup> Armenteros-Yeguas V, Gárate-Echenique L, Tomás-López MA, Cristóbal-Domínguez E, Moreno-de Gusmão B, Miranda-Serrano E, et al. Prevalence of difficult venous access and associated risk factors in highly complex hospitalised patients. *J Clin Nurs.* 2017;26(23–24):4267–75.
- <sup>vi</sup> Lee HC, Lee CC, Lin TC, Liu CI. Spontaneous rupture of the esophagus - A case report. *J Intern Med Taiwan.* 2007;18(1):40–4.
- <sup>vii</sup> Lai NM, Lai NA, O’Riordan E, Chaiyakunapruk N, Taylor JE, Tan K. Skin antisepsis for reducing central venous catheter-related infections. *Cochrane Database Syst Rev.* 2016;2016(7).
- <sup>viii</sup> Jamshidi N, Molazem Z, Sharif F, Torabizadeh C, Kalyani MN. The Challenges of Nursing Students in the Clinical Learning Environment: A Qualitative Study. *Sci World J.* 2016;2016
- <sup>ix</sup> Khalil R, Mansour AE, Fadda WA, Almisnid K, Aldamegh M, Al-Nafeesah A, et al. The sudden transition to synchronized online learning during the COVID-19 pandemic in Saudi Arabia: A qualitative study exploring medical students’ perspectives. *BMC Med Educ.* 2020;20(1):1–10.