

## Teaching and testing basic surgical skills without using patients

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### ABSTRACT

**Background:** Nowadays, clinical skills centers are important structural components of authentic universities in the world. These centers can be used for tuition of cognitive, affective and psychomotor skills. In this study we have designed a surgical course, consist of 19 theoretical knowledge (cognitive skills) and 10 procedural skills.

**Purpose:** teaching and testing the designed course.

**Methods:** This study has been conducted on 678 medical students at clerkship stage. Pre and post-self assessment technique has been used to assess learning progress. A multivariate statistical comparison were adapted for Judgments of learning achievement, Hotelling's T-square has been used to ascertain the differences between pre and post tests score. For measuring the reliability of the test items. Cronbach's Alpha has been used to measure the reliability of test item.

**Results:** The reliability of the test was 0.84 for cognitive skills and 0.92 for procedural skills. The two tailed test for comparing each pairs of score of 19 cognitive items showed a significant statistical difference between 13 items ( $P=0.000$ ). For procedural skills the differences between the mean score of 9 items were significant ( $P=0.000$ ). These results indicate learning achievements by students.

**Conclusion:** This study suggests that, the ability of trainees in both cognitive and psychomotor skills can be improved by tuition of basic surgical skills in skill Lab. (without use of patients).

**Key words:** BASIC SURGICAL SKILLS, CSC, (CLINICAL SKILLS CENTER) PRE AND POST SELF-ASSESSMENT.

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### Introduction

The need for inexperienced learners to build a framework of basic skills before carrying out surgical procedures on patients has long been known by medical educationist. Effective learning of a skill requires sustained deliberate practice within a cognitive framework, and simulation offers an opportunity for safe preparation (1).

Students must be confident that they do no harm their patient, and are not embarrassed by their learning. They must practice the necessary skills under direct supervision and receive immediate feedback on their performance (2).

For preparing these facilities:

We can apply a combination of information (presented by computer, lecturing, or small group discussion) and practice of psychomotor skills

(using simulated models) for teaching practical skills (e.g. basic surgical skills) (1-2).

Dr. Krummel believes" that, the virtual reality technology is rapidly moving into the operating rooms and medical schools. This technology will help medical teachers and the safety of students as well as patients" (3).

Clinical skills centers can be established to provide learning facility for teaching basic surgical skills. A wide range of learning methods can be adopted in these centers including: small group work, role-play, role model, demonstration, simulated and standardized patients, audio and video recording, computerized models, and real patients (1-4).

Nowadays such facilities (CSC: Clinical Skills Centers) are an important component of authentic universities in the world. For example: the Royal college of surgeons (RCS) of Edinburgh runs ten basic surgical skills courses per year in their

surgical skills laboratory. The material contains texts and illustrations and clips (as CDs and Videos) that deal with the preparation of the operating environment, scrubbing, handling instruments, tying knots, suturing of various kinds, management of bleeding, the cleaning of wounds and application of plaster.

There are sections of suturing of various structures (e.g. blood vessels and intestine), the safe use of diathermy (heat coagulation to stop bleeding or to cut tissue) and safe laparoscopic surgery (5-6).

We have established such a center (CSC) in our university in recent years. A surgical course has been designed with 19 theoretical and 10 practical objectives.

To determine the efficiency of this course, we have administered self-assessment primary pre-test at the beginning of the course and secondary pre-test (secondary pre-test has been implemented in order to find out if students doubted about their scoring at first day. They have been asked to pretend it is the first day of the course, score your first day knowledge again), and post test at the end of the course.

## Materials and Method

This study is conducted on 398 Medical students at clerkship stage in clinical skills center affiliated to medical schools of Tehran University of Medical Sciences in Iran. A basic clinical surgery course, has been designed, implemented and evaluated, which consisted of 19 theoretical subjects (cognitive skills) and 10 practical one (Psychomotor skills).

We have used pre and post-self assessment technique by the learners in this study. In this method, the learners assess themselves by scoring their cognitive and practical skills on a zero to 10 sores, before beginning of the course.

The **multivariate** statistical comparison was adopted for judging the learning achievements by using self-assessment in **19 cognitive (theoretical) and 10 procedural skills**.

Hotelling T-square was used to ascertain the differences between post and pre-test self-assessment scores.

Two-tailed T test were adopted to determine the significant of differences between each pairs of test items in pre and post -self-assessment (7).

Learning achievements scores for each test item has been determined by measuring the difference between pre and post assessments as follow:

### For 19 items of cognitive skills.

= **learning achievement** (difference between secondary pre- test and post- test self - assessment score).

= **learning achievement** (difference between mean score primary self-assessment and post- test score).

= **the difference between secondary and primary pre- self assessments scores** (in order to determine whether or not the student over estimated their knowledge)

### For 10 procedural skills

= **learning achievement** (difference between secondary self assessment and post test score)

= **learning achievement** (difference between primary self-assessment and post test score).

= **the difference between secondary and primary pre- self-assessments scores.**

Cronbach's Alpha was used for measuring the reliability of test items.

There was no any ethical limitation in this study.

## Results

### A - Theoretical (or cognitive skills)

The reliability of test for 19 cognitive skills was 0.84 (as measured by Cronbach's Alpha).

The sample sizes are different for different variables because of non- response to some test items, the largest sample size belong to post- test and primary pre-test on procedural skills ( N=678). Number of observations for the Pairs post – test and secondary pre–test was 398, and N=633 for pairs of post test and primary pre- test, N=309 for primary and secondary pre-tests, as shows in table 1.

According to table 1, the Rectal examination method has the lowest learning achievement mean score, when one compare the post assessment with the secondary pre-test score, while Naming of common instrument to be used in ambulatory surgery had the highest learning achievement mean score.

Comparing post test with primary pre test again rectal examination method had the lowest learning achievement mean score while the type of Nasogastric tubes and the method of N.G.T.

**TABLE 1.** Learning achievements of 19 cognitive skills among medical students at clerkship stage

Skills	(N=398)		(N=633)		(N=309)	
	Mean	SE	Mean	SE	Mean	SE
1. Naming of the common instruments to be used in ambulatory surgery.	5.33	2.31	4.95	2.71	-0.019	3.14
2. Application of the common instruments to be used in ambulatory surgery.	5.13	2.30	4.94	2.87	0.93	3.22
3. Type of the surgical needles and strings.	5.11	2.66	4.92	4.81	-0.12	3.51
4. Applications of the surgical needles and strings.	4.51	2.62	4.63	3.20	1.97	3.24
5. Types of common disinfectants to be used in surgeries.	4.58	4.86	4.52	4.34	-1.10	2.97
6. Principles of examining the traumatic lesions.	3.75	2.56	4.58	3.23	0.10	3.68
7. Preparing of the lesions for repairing.	3.88	2.64	4.45	3.14	0.68	3.94
8. Common drugs to be used in local anesthesia.	3.36	2.75	4.37	3.08	1.15	3.47
9. Local anesthesia methods.	4.46	2.81	4.99	3.12	0.81	3.86
10. Types of the sutures and surgical knots.	4.51	2.95	5.24	3.11	0.76	3.94
11. Applications of the different sutures.	4.10	2.72	5.01	3.18	0.81	3.56
12. Principles of the bandage of the lesions.	3.98	4.87	5.36	2.98	0.82	6.03
13. Follow up the lesions after suturing and bandage.	4.05	4.81	5.25	4.59	1.59	3.75
14. Indications and contraindications of rectal examination.	3.54	2.75	4.67	3.48	1.18	4.37
15. Rectal examination methods.	2.93	2.88	3.20	3.73	0.33	4.45
16. Types of nasogastric tubes and the methods of N.G.T placement.	5.32	4.96	5.86	3.13	0.88	3.96
17. Types of urinary catheters and condom bags.	3.94	3.04	5.01	3.41	1.14	4.41
18. Indications and contraindications of urinary catheterization.	3.32	2.93	4.61	3.67	1.32	4.78
19. The methods of urinary catheterization and condom bag placement.	3.70	7.10	5.09	3.54	1.47	8.66
<b>Analytic Results</b>	Hotelling T Square=445.33 F=23.68 Df=18 <b>P=0.000</b>		Hotelling T Square=508.21 F=27.47 Df=18 <b>P=0.000</b>		Hotelling T Square=122.64 F=6.43 Df=18 <b>P=0.000</b>	

Placement had the highest learning achievement mean score.

According to our findings, the difference between the secondary and the primary pre-tests mean scores for the Types of common disinfectant to be used in surgery had a negative value, which means in primary pre-test, students over estimated their knowledge. However this incident repeated in Naming of common instruments to be used in ambulatory and Type of common surgical needles and strings.

In each of 3 comparisons made between ( $\bar{Z}, \bar{Y}, \bar{X}$ ) the multivariate analysis of data shows a significant statistical differences  $p=0.000$  for

mean scores of post and pre - test for 19 items (table 1).

The two tailed tests comparing individual pairs of scores of 19 items showed a strong statistical differences between all items ( $p = 0.000$ ) except the following ones (table 2).

1. Naming of common instruments, to be used in ambulatory surgery.
2. Application of instrument to be used in ambulatory surgery.
3. Type of surgical needles and strings .
4. Application of surgical needles and strings
5. Type of common disinfectants to be used in surgeries.
6. Rectal examination methods

**TABLE 2.** Results of paired sample two tailed t-test (post and pre self assessment) for 19 items

Skills	Df	Sig.(2-tailed)
1. Naming of the common instruments to be used in ambulatory surgery.	343	0.566
2. Application of the common instruments to be used in ambulatory surgery	340	0.430
3. Type of the surgical needles and strings.	341	0.665
4. Applications of the surgical needles and strings	337	0.146
5. Types of common disinfectants to be used in surgeries.	338	0.894
6. Principles of examining the traumatic lesions	338	0.000
7. Preparing of the lesions for repairing.	337	0.02
8. Common drugs to be used in local anaesthesia.	338	0.000
9. Local anaesthesia methods.	337	0.000
10. Types of the sutures and surgical knots.	338	0.000
11. Applications of the different sutures.	336	0.000
12. principles of the bandage of the lesions	342	0.000
13. Follow up the lesions after suturing and bandage	336	0.000
14. Indications and contraindications of rectal examination.	336	0.000
15. Rectal examination methods	337	0.088
16. Types of nasogastric tubes and the methods of N.G.T placement	340	0.000
17. Types of urinary catheters and condom bags.	339	0.000
18. Indications and contraindications of urinary catheterization	337	0.000
19. The methods of urinary catheterization and condom bag placement.	334	0.000

**B- Procedural skills**

Cronbach's Alpha for reliability of 10 procedural items was 0.92.

The population sample for each pairs of data were:

1. N= 339 for post test and secondly pre-test.
2. N= 678 for post test and Primary pre-test.

3. N=337 for secondary and primary pre test.

The results of the study show that highest learning achievement mean score was N.G.T placement on adults and Urinary catheterization in women when using secondary pre test score (table 3) while the

**TABLE 3.** Learning achievements for 10 procedural skills in medical students at clerkship stage

Procedural skills	N=338		N=678		N=337	
	Mean	SE	Mean	SE	Mean	SE
1. Wearing of sterile gloves	2.52	3.31	1.74	3.6	-0.50	4.69
2. Selection of the ambulatory surgical instruments.	4.31	2.64	4.88	3.20	0.74	4.00
3. Accomplishing of local anaesthesia.	4.05	2.95	4.72	4.54	0.65	4.4
4. Suturing .	4.17	3.06	4.27	3.56	0.24	4.72
5. Removing the sutures.	3.53	3.50	4.22	4.51	0.44	4.86
6. Tying knots with an instrument.	4.16	3.36	4.51	3.89	0.33	5.14
7. Bandage and dressing.	3.78	2.98	4.54	3.36	0.75	4.35
8. Urinary catheterization and condom bag placement in men.	4.40	3.21	5.29	3.79	1.02	4.89
9. N.G.T placement in adults.	5.29	3.18	6.24	3.29	1.08	3.98
10. Urinary catheterization in women.	5.27	3.37	6.29	3.75	0.88	4.29
<b>Analytic Results</b>	Hotelling T Square=144		Hotelling T Square=481		Hotelling T Square=357.09	
	F=7.59		F=26.02		F=18.27	
	Df=9		Df=9		Df=9	
	<b>P=0.000</b>		<b>P=0.000</b>		<b>P=0.000</b>	

Lowest learning achievement mean score belongs to wearing of sterile gloves.

Using primary pre self assessment, the findings shows the highest mean score belongs to Urinary catheterization in woman and N.G.T. placement in adults.

The finding between to pre self assessment scores shows that students over estimated their skills in wearing of sterile gloves. (table 3).

The multivariate analysis of data in procedural skills showed that there were statistical differences between the post and pre-test and pre-test.

The two tails- test in pairs of scores in 10 items procedural skills showed statistical differences between all items except the Wearing of sterile gloves (table4).

**TABLE 4.** Paired sample test for 10 items according to two tailed t test.

<b>Procedural skills</b>	<b>Df</b>	<b>Sig 2-tailed</b>
1=Wearing of sterile gloves.	334	0.09
2=Selection of the ambulatory surgical equipments.	337	0.01
3=Accomplishing of local anaesthesia.	338	0.02
4=Suturing.	329	0.001
5=Removing the sutures.	337	0.00
6=Tying knots with an instrument.	338	0.04
7=Bandage and dressing.	339	0.01
8=Urinary catheterization and condom bag placement in men.	336	0.01
9= N.G.T placement in adults.	335	0.02
10 =Urinary catheterization in women.	318	0.00

## Discussion

This study has been conducted on 678 medical students at clerkship stage. The students were required to get familiarization with 19 cognitive and 10 practical skills during 2 days tuition.

The student's self- assessed their own progress using a quantitative pre- and post test. The findings of this study indicate that use of simulators and, manikins in practical skills tuition have a positive effect on student learning achievement. In similar study conducted in the North -Western University in The United States, with using the standardized patients, the students were taught several clinical skills before their entrance to clinical wards. The findings of evaluation of this course, has been Shown that, the response of learners was extremely positive (8). In another study conducted in Texas University, the application of simulation devices and manikins in teaching some clinical skills were assessed, and its findings have also indicated that using of simulators and manikins in clinical teaching are effective. Also this method prepare the students for better learning in the hospital(9). These findings are in agreement compatible with our findings.

One of the practical skills in our study was "Rectal Examination". Although this items had the lowest mean score in comparison with the other 18 subjects, however the multivariate analysis of pre and post tests scores including this item is highly significant (P=0.001). A related study has compared the "Rectal examination" teaching efficacy, using two traditional and simulated methods in Newfawland faculty of medicine in Canada. In this study, after the implementation of the instructional program in two groups, the student's performance and satisfaction were assessed by a questionnaire and OSCE method. A significant satisfaction rate (P=0.025).has been reported(10). These two findings are supported our finding.

Another practical skill in our study was tying the surgical knots and suturing. The findings indicate that, our tuition for this skills in our SCS was effective (P=0.001). This finding is supported by a comparative study, assessing surgical knots before and after tuition in London, concluded that, knot-tying workshops could improve the ability of trainees to tie knots (11).

## Conclusion

This study suggests that, the ability of trainees in both cognitive and psychomotor skills in medical education can be improved by tuition of basic surgical skills in skill Lab (without use of patients).

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