Effectiveness of Four Step Approach for Procedures (Skill) Teaching: RCT

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Abstract: Introduction: Clinical skills development is an essential component of the education of a competent physician. Skill teaching with 4 step approach requires evidences to prove its superiority in better skill acquisition & retention as compared to traditional methods. **Method:** Randomized controlled Double-blinded cross over group study carried out on2 groups of randomly selected fourth term medical students using 2 teachers to teach 2 different procedure by traditional versus four step approach. Skill acquisition for each procedure was assessed by Observed Structured Practical Examination (OSPE). Pre-designed validated feedback form was used to rate both the method on five point Likert scale. **Result:** Better skill acquisition with statistically significant difference was shown, when taught by four step approach compared with traditional method irrespective of the group. Students 'perceptions on different aspects of teaching was significantly positive for 4 step approach. **Conclusion:** Four step approach is both a more effective & efficient teaching method than traditional method for skill acquisition, which is perceived as bringing confidence, comfort & satisfaction. Study proves improvement in short term recall. To check long term retention, longitudinal study is required.

Key words: Four step approach, Skill acquisition, teaching skill

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Introduction: The medical profession, in its many facets, makes extensive use of the three major learning domains: cognitive, affective and psychomotor. Psychomotor (Doing) domain deals with acquisition of skills that require varying levels of well-coordinated physical ability in precise manipulative procedures requiring neuromuscular co-ordination.

During the past 150 years the advancement of medical science and technology coupled with an ever-changing clinical arena and demands has brought into question our continued passion for the teaching and learning of these 'ancient arts'. Clinical skills development is an essential component of the education of a competent physician.Flegel[1] suggests that clinical

examination skills are the bridge between the patient's history and the investigations required in making a diagnosis: an 'adjunct to careful, technology-led investigations'. With increasing economic consideration of expensive investigations load on patients, it may be argued that we should be increasing the teaching and learning of clinical skills, honing our skills to make expensive investigation focused and appropriate[2].

Traditionally, medical teachers explain theory and demonstrate procedure, then trainees' practices ("see one, do one"). This traditional "2-step approach" has been criticized due to inadequate skill acquisition and retention[3]which ultimately result in source of anxiety for students and poses potential risks to patients. Furthermore, traditional teaching was challenged by society's reaction to medical errors [4, 5] changes in the medical educational paradigm focusing on student centered teaching, [6] the increasing number of medical students[7] and the legislative reduction in training time during specialization.[8–11]

There are some newer teaching Methods to improve learning i.e.4 step approach to teaching skills, Standardized/Simulated patients, Procedure courses/videos/textbooks, Web-based training, Cadavers and Live animals. Skill teaching with 4 step approach requires evidences to prove its superiority in better skill acquisition & retention as compared to traditional methods.

Observe, record, tabulate and communicate. Use your five senses… Learn to see, learn to hear, learn to feel, learn to smell, and know that by practice alone you can become expert' is the base on which The "4-step approach" is designed to bring expertise. R. Peyton, a general surgeon has described this excellent and widely advocated model for teaching clinical skills known as the '**four-step approach.**[12, 13] It comprises ofStep-1.Demonstration: Demonstration of skill by teacher at its original speed with no explanation., Step-2. Deconstruction: Teacher repeats the skill step by step, explaining theory behind the facts and details, Step-3. Comprehension / Formulation: Teacher performs the skill for third time, with the learner providing explanation of each step and being questioned on key issues, Step-4. Performance: Learner now carries out skill under close supervision describing each step before it is taken. Some authors' mention additional Step-5. Practice Application: Students become teacher and repeat cycle of skill.

The approach has been widely accepted& used for years with no evidence of better skill acquisition and retention for practical skill training replacing the traditional 2 steps. ("See one, do one") Medical educators need high quality data to address the knowledge gaps of this new approach. Hence, present study was done to find out effectiveness of 4 Step Approach to Teaching Skills. (Procedure)

Method

To see the effectiveness of 4 step approach, Randomized controlled Double-blinded cross over group study was undertaken, after taking permission from Head of the institute, Government medical college, Bhavnagar (Gujarat). Study group consist of randomly selected 20, fourth term medical students from the batch of 150 students. They were divided in to two groups i.e. Group A and Group B. Two teachers (X and Y) from the first year were

invited to teach two clinical procedures viz.(1) Measurement of blood pressure in supine position. (2) Rinne's test for diagnosis of deafness. Measurement of blood pressure in supine position was taught to Group Aby teacher X using traditional Method and to Group B by teacher Y using 4-step approach. Followed by Crossover of group so, Rinne's test was taught to Group A by teacher Y using 4-step approach and to group B by teacher X using traditional Method.

Skill acquisition for each procedure was assessed on second day by Objectively Structured Practical Examination (OSPE).Assessors were blinded to the teaching method used for each procedure. For more objectivity, the observers were provided with a detailed, itemized checklist on which to mark the candidate's performance. Predesigned validated feedback form was given to student (appendix -1) to rate both the method on five point Likert scale on different 20 aspects. Result of OSPE and feedback on five point Likert scale about traditional method were compared with 4-step approach using student T test.

Result: Initially 20 students were selected for the study but due to 3 dropouts on the second day, study was completed with 17 students. Out of 17 students there were 8 females and 9 males having average age of 18±0.5 years. Study group was diverse, representing different part of the state, different socioeconomic class and from both law and high achiever group.

Assessment for both the procedure was carried out using objectively structured practical examination. Result is tabulated in Table I.

Table 1: OSPE score (Result)

	Procedure 1		Procedure 2		Combined result	
Teaching Approach	4 step	Traditional	4 step	Traditional	4 step	Traditional
Group	Group B	Group A	Group A	Group B	Group A+B	Group A+B
Mean	93.8	77.8	87.8	72.2	90.6	79.4
SD	8.6	14.4	10.9	29.9	10.1	13.7
P	0.015		0.077		0.01237	

The difference observed between OSPE score shows that there is statistically significant difference between results of both group revealing improvement and higher scoring of skill acquisition, when taught by four step approach compared with traditional method irrespective of the group.

Table 2: Students perceptions on different aspects of teaching (Feedback)

Question No.		1	2	3	4	5	6	7	8	9	10
Four step Approach	Average	4.4118	4.5294	4.5294	4.5882	4.4118	4.2353	4.7647	4.2941	4.5294	4.4706
	SD	0.9428	0.8498	0.7048	0.7048	0.9218	0.9075	0.7584	1.0981	1.1660	1.4371
Traditional Method	Average	4.0588	4.1176	3.5294	3.9412	4.0000	3.7647	3.9412	3.4118	3.8235	3.7059
	SD	0.8758	0.8823	0.6872	0.5241	0.7050	0.9367	0.9946	1.2923	1.4114	1.6509
	P	0.0547	0.0688	**0.0004**	**0.0004**	0.1302	**0.0413**	**0.0007**	**0.0003**	**0.0006**	**0.0076**
Question No.		**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Four step Approach	Average	4.4118	4.2941	4.5294	4.7647	4.2353	4.6471	4.5294	4.1176	4.8235	4.7059
	SD	1.7675	1.9943	2.0864	2.2177	2.6178	2.7398	3.0400	3.4109	3.3631	3.6497
Traditional Method	Average	3.8824	3.4118	3.8824	3.8824	3.6471	3.5882	3.4118	3.2353	3.5882	4.0588
	SD	1.8523	2.1602	2.2915	2.5027	2.7486	2.9633	3.2062	3.4927	3.6753	3.7689
	P	0.1551	**0.0021**	**0.0366**	**0.0033**	**0.0280**	**0.0006**	**0.0001**	**0.0021**	**0.0001**	**0.0165**

Out of 20 questions on perception about 4 step approach v/s traditional method, statistically significant positive ratings were marked by students on 15 aspects for 4 step approach. However, a negative rating that four-step approach takes more time was the perception of students, which was also statistically significant.

Discussion

Our experiment on four step approach has provided us preliminary support that it is effective & efficient method of teaching skills which is going to improve learning outcomes.

OSPE scores of each procedure, when observed separately as well as in combination according to teaching approach shows statistically significant high score by reason of better skill acquisition in group taught by four step approach. So, it is evident that, learner skill acquisition is taking place up to highest level of Millers pyramid – 'Does', in 4 step approach as compared to traditional method where students reach only up to 'knows how'.

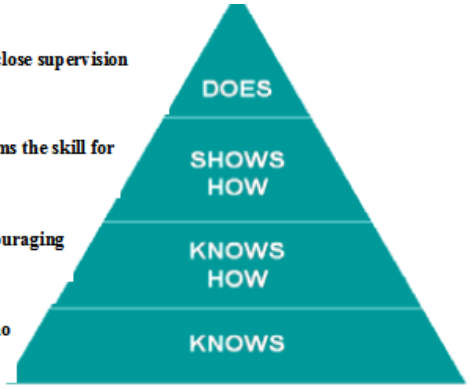
Skill acquisition through 4 steps Approach can be plotted on Millers pyramid as below:

Step 4 : (Performance): Learner now carries out skill under close supervision describing each step before it is taken

Step 3 : (comprehension phase / formulation): Demonstrator performs the skill for third time, with the learner providing explanation of each step

Step 2 : (deconstruction phase): Repetition of skill with full explanation, encouraging learner to ask question:

Step 1 : (demonstration phase): Demonstration of skill at normal speed with little or no explanation:



Four step Approch **Millers pyramid**

As described by Albert Bandura,[14] Instructions can be made more efficient by modelling desired behaviours of functional value to learners and by providing situations which allow learners to use or practice that behaviour to improve retention. In 'four-step approach' instructor role models the skill which students are going to imitate. Same was endorsed by Kearsley[14]in his principle 'the highest level of observational learning is achieved by first organizing and rehearsing the modelled behaviour symbolically and then enacting it overtly'.

B. F. Skinner's in his article "The Science of Learning and the Art of Teaching", stated that effective instructional materials, called programmed instructional materials, should include small steps, frequent questions, immediate feedback, and self-pacing.[15]The 4 step approach by including all these programmed instructional materials foster students concern to learn skills, interact effectively with their teachers, improve their learning abilities and prepare them to become clinically competent.

In general, investigators have shown that increased repetition during training improves the degree of original learning, results in enhanced motor and verbal task retention[16]and transfer[17].Teaching skill through 4 step approach includes many repetitions in its design. Further by modification in final step of instructing learners to become teacher to teach the skill to fellow students allow rehearsal of maintenance & elaborative type which help students to store information in long term memory.

According to Dual coding theory, we remember better, when two processes are engage such as visual and verbal learning, this strategies cause positive transfer resulting in long term memory. Learning skill through 4 step approach involves both strategies causing positive transfer, so students develop long term procedural memory of both implicit & explicit nature. Factors enhancing skill acquisition through 'four step approach' also include observational practice, focus of attention, feedback, reinforcement and self controlled practice. Student perceptions about 4 step approach v/s traditional method on Likert scale reveals several strengths of 4 step approach: (1) Learning by doing is a particularly effective method for skill development (2) Increased student–teacher interaction and skill practice time offered by this method allow students not only to strengthen their basic skill ability, but also to contribute more effectively in day to day performance of procedure. (3) Overall students rated good experience with 4 step approach and they suggested that it should be routine approach to teach procedures. (4) A problem with 4 step approach that step-by-step process of controlling task performance occupies attention capacity which in turn reduces the performer's ability to focus on other aspects of the performance, such as decision making, fine motor-skills and self-monitoring of energy level and practice can also be reasoned by the fact that with practice procedural knowledge develops, which operates largely outside of working memory, and thus allows for skills to be executed more automatically.

Conclusion

Teaching using 4 step approach v/s traditional method was tested on actual medical students & therefore it can be stated that four step approach is both a

more effective & efficient teaching method than traditional method. Four step approach of teaching skill cause well organization of knowledge in memory, which help make the students' knowledge & reasoning visible for analysis & instruction. Students enjoy learning by four step approach and found that they are able to perform the procedure with sense of comfort and confidence. Students and teachers express high levels of satisfaction with this approach Study proves improvement in short term recall, to check long term retention longitudinal study is required.

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Appendix 1

Feedback Form

Roll No: **Age/sex:**

Score your perceptions about the exercise taught to you by Dr. C &Dr. M according to Likert Scale:

Strongly disagrees 1 / disagree 2/ don't know 3 / agree 4 / Strongly agree 5

Sr. No	Perceptions	4- step approach	Traditional approach
1	I know what is the optimal time taken to do the procedure in reality(Real time)		
2	I can imitate better due to role modelling of procedure by teacher		
3	I can perform better due to breakdown of procedure in series of small steps		
4	Verbalization of each step help me to memorize it		
5	I can recall the steps of procedure more easily		
6	My learning has enhanced due to involvement of multiple senses		
7	It is better structured learning activity.		
8	Team work has promoted my learning –Cooperative learning		
9	I felt better hands on practice with this steps approach of learning procedure		
10	It was better guided learning activity, I know Why & when about procedure		
11	I get immediate feedback about my learnt skill		
12	The procedure has more clearly defined outcome &learning goals		
13	My timings of performing the correct procedure improved with each attempt		
14	I will be able to remember the skill for long time(Longer Retention)		
15	I can self evaluate my performance of skill		
16	My precision increases as I teach the procedure to other		
17	I feel more competent to do the procedure		
18	I feel it takes more time to learn the procedure by steps approach		
19	Overall experience in learning this exercise was enjoyable (Good)		
20	I was able to perform the exercise with confidence in exam		