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Effect of Role-Modeling (Modelling) Clinical Skills and ProfessionalBehavior on the Learning of Medical Students as Measured through Pre and Post-test Assessment

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ABSTRACT

Objectives: To examine the effect of role-modelling (modelling) clinical skills and professional behaviour on the learning of fourth-year medical students through pre and post-test.

Study Design: Quasi-experimental study.

Place and Duration of Study: Ophthalmology Department, Rawalpindi Medical University, Pakistan, from Jan to Feb 2019.

Methodology: Two Groups were formed, the Study and Control-Group, with 30 students from 4th-year MBBS. The Study-Group was exposed to role-modelling intervention accompanied by the verbal narration of steps after being given a pre-test and retested with a post-test after two weeks. The Control-Group was also given pre and post-tests with a verbal description of steps without modelling the drill. Each test was observed by three different observers.

Results: Total mean score given by observers in the Study- Group was 71.53±12.38 in the pre-test, which was statistically significantly improved to 92.07±13.12 in the post-test (*p*-value 0.0001), an improvement of 28.71% after modelling intervention. All observers in the Control-Group gave a total mean score was 74.93±12.90 in the pre-test and 74.53±12.83 in the post-test (*p*-value 0.634). After applying ANOVA on inter-observer difference, there was no statistically significant difference in the mean score given by observers ($p>0.05$).

Conclusion: Role-modelling or modelling as a means of demonstrating clinical skills and behaviour is effective teaching or instructional strategy measured through pre and post-test.

Key Words: Instructional strategies, Modelling, medical students, Pre-test, Post-test role-modelling.

How to Cite This Article: *Niazi FAK, Khaliq T. Effect of Role-Modeling (Modelling) Clinical Skills and Professional Behavior on the Learning of Medical Students as Measured through Pre and Post-test Assessment. Pak Armed Forces Med J 2022; 72(5): 1602-1606. DOI: https://doi.org/10.51253/pafmj.v72i5.5292*

INTRODUCTION

Role models are admired for how they act, their professionalism, and their behaviour is considered a standard of excellence. Therefore, role modelling may be considered a process that provides learners with an example to imitate. This exposure to role modelling can be over some time, a one-off session or just a glimpse. Learning through role models is a consequence of observation and reflection. Through reflection on a process, an unconscious feeling can be converted into conscious thought and put into practice. Similarly, observed practices are incorporated into beliefs and behaviors.[1]

Bandura helps in understanding the concept of learning through role modelling. He suggests that learning is a reciprocal interplay between people, their behaviour and the environment. He describes five ways in which individuals learn. One of these is vicarious learning, where they learn by observing others' actions and the consequences of those actions. In the dynamic environment of professional clinical practice, students have many opportunities to observe and learn from others, including residents and attending staff, making learning less cumbersome.[2] Moreover, students have different learning styles, making it essential to use diverse teaching strategies. Finally, reflectors like to sit back and observe before advancing to a higher application level.[3] Role modelling can be especially effective for these learners.

Modelling is generally described to have the following types: Dispositional modelling teaches values and behaviour; Task and behaviour modelling is typically done before a science experiment or a physical exercise and can be used to teach any methodical sequence of skills that a student is expected to repeat later; in metacognitive modelling the teacher uses 'thinks out loud approach, to describe the underlying thought processes while solving a problem.[4]

Historically, role modelling has had an important place in medical education. Medical students' observations of behaviours, specifically those of their role models, are believed to affect learning more than formal teaching.[5] Lee, in his article, highlights that teaching, role modelling, and assessing the competency of professionalism are important tasks in managing the ACGME mandate for training programs in Ophthalmology.[6] Despite the interest in role modelling as a

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Received: 09 Sep 2020; revision received: 25 Apr 2021; accepted: 29 Apr 2021

valuable teaching strategy in medical education, medical literature remains inconsistent and inconclusive, with quite a few counter-arguments regarding its efficiency as an instruction technique. This difference in opinion seems to arise from the differing explanations of the term in the context of medical education. If defined as the demonstration of skills, provision of feedback, and emulation of specific professional behaviours, then role modelling is an important component of clinical training. We must focus more critically on this fundamental aspect of physicians' professional enhancement to benefit both faculty and learners.[7]

Studies to objectively measure the impact on students is almost non-existent. Although role-modelling has been used in teaching clinical skills, values and attitudes, most recent work has focused on the affective domain and professionalism. Therefore, there was a strong need for a study assessing the real impact of using role modelling as an instructional strategy to teach clinical skills and professional attitudes. In this study, an attempt will be made to objectively quantify the impact of role modelling on teaching clinical/ counselling skills and the professional behaviour of medical students.

METHODOLOGY

This quasi-experimental study, including the Study and Control-Group, was carried out at the Ophthalmology Department, Rawalpindi Medical University Pakistan, from January to February 2019. Formal approval was taken from Institutional Ethical Review Board (via Ref no R-17/RMU dated 17-05-2018). For the intervention, real standardized patients of third nerve palsy were recruited. The sample size was calculated using G*power software by considering within-Group improvement and between-Group differences in means test scores. In addition, the impact of role-modelling on post-test scores from baseline was considered. The confidence level was set at 95% and the power of study at 80 percent with the two-sided hypothesis. We assumed moderate effect size of 0.508 therefore, a sample size of 60 students (30 in each Group) was taken.

Inclusion Criteria: Undergraduate MBBS students of the 4th year class of both genders who had a clinical rotation in the ophthalmology ward during the study period were included.

Exclusion Criteria: Students who had been relegated from previous secession and allied health sciences students were excluded from the study.

Convenience consecutive sampling technique in a multistage way was used where the first four clinical rotation batches were selected as representative of a class of 300. As strabismology was taught in lectures during the second half of the year, four initial and consecutive batches were included. Two batches were allocated to the Study-Group and two to the Control-Group. Specific allocation was done through a simple lottery, giving each batch an equal opportunity to be a part of either Group. Consent was taken from both the participants and the patients. Both pre and post-test were given to each participant. A verbal description of the steps was given prior to each test. All participants in the Study-Group were exposed to a one-shot role-modelling intervention simultaneously on the first day after being given a pre-test. A verbal narration of the steps also accompanied the modelling demonstration. The Control-Group was only given a verbal description of steps without modelling the drill. Both Groups were retested with a post-test after two weeks on their respective final day of the rotation. Each test was observed by three different observers.

The three assessors included the researcher and two consultants with similar qualifications. As we recorded behavioural observations of performance while each student examined a patient with third nerve palsy, a checklist was prepared.[9] Checklist was used to score every participant in examining and counselling the patient. General guidelines were followed to develop a checklist. First, intention and variables were identified with operational definitions. After reviewing the literature and discussing it with expert colleagues, a list of items was prepared, modified and organized. The list was assessed for validity and reliability and pilot tested on some junior house officers. Necessary amendments were done, and printouts were taken for use.[10,11]

The summed-up test scores were recorded for comparison. The net or difference score was indicative of the change in an individual. Statistical Package for Social Sciences (SPSS) version 21:00 was used for the data analysis and paired t-test was applied. ANOVA was used for inter-rater reliability by comparing the average scores given by three assessors. The *p*-value lower than or up to 0.05 was considered as significant.

RESULTS

A total of 60 students participated in the study, of which 18 (30%) were males and 42 (70%) were females. The age range of the students was from 21-24 years, with the mean age of 21.78±0.24 years.

The mean score given by all observers in the Study-Group was statistically significantly improved in the post-test after modelling intervention, as shown in Table-I. Mean score differences in pre-test and post-test of all observers were statistically insignificant in the Control-Group (*p*-values>0.05) as shown Table-II.

Table-I: Mean Score of Observers Pre-test and Post-test in Study-Group (n=60)

Study-Group	Mean±SD	*p*-value
Observer 1 Pre test	24.93±4.07	0.0001
Observer 1 post test	29.73±2.89	
Observer 2 Pre test	22.93±5.56	0.0001
Observer 2 post test	32.67±7.15	
Observer 3 Pre test	23.67±4.01	0.0003
Observer 3 post test	29.67±4.82	
Total Pre-test	71.53±12.36	0.0001
Total post test	92.07±13.12	

Table-II: Mean score of Observers Pre-Test and Post-Test in Control-Group (n=60)

Control-Group	Mean±SD	*p*-value
Observer 1 Pre-Test	24.93±4.02	0.683
Observer 1 Post Test	24.73±3.80	
Observer 2 Pre-Test	25.27±5.80	1.000
Observer 2 Post Test	25.53±5.48	
Observer 3 Pre-Test	24.73±4.14	0.683
Observer 3 Post Test	24.53±5.01	
Total pre-test	74.93±12.90	0.634
Total posttest	74.53±12.83	

The total mean score given by all observers in the post-test of the study-Group was 92.07±13.12, which was a statistically significant difference from the mean score of 74.53±12.83 given in the post-test of the Control-Group (*p*-value 0.0001). There was no statistically significant difference in mean scores given by each observer in the pre (*p*-value 0.491) and post-test (*p*-value 0.215) setting of the Study Group, as shown in Table-III.

Table-III: Anova Pre-Test and Post-Tests in Study-Group (n=60)

Study-Group	Observer 1	Observer 2	Observer 3	*p*-value
Pre Test Between Observers	24.93±4.07	22.93±5.56	23.67±4.01	0.491
Post Test Between Observers	29.73±2.89	32.67±7.15	29.67±4.82	0.215

After applying ANOVA to inter-observer difference, there was no statistically significant difference in mean scores given by each observer in the pre (*p*-value 0.953) and post-test (*p*-value 0.912) setting of the Control-Group, as shown in Table-IV.

Table-IV: ANOVA; Pre-Test and Post-Tests in Control-Group (n=60)

Control-Group	Observer 1	Observer 2	Observer 3	*p*-value
Pre Test Between observers	24.93±4.02	24.93±4.02	24.93±4.02	0.953
Post Test Between Observers	25.53±5.48	25.53±5.48	25.53±5.48	0.912

DISCUSSION

In this study, we have shown a significant improvement in the post-test performance of the Group of 4th-year medical students exposed to role modelling or modelling intervention as an instructional strategy. The mean total score given by all observers in the Study-Group was 74.53±12.839 in the pre-test, which was statistically significantly improved to 92.07±13.128 in the post-test (*p*-value=0.0001), an improvement of 28.71%. Silent modelling without linguistic support is considered insufficient, as a synchronized explanation is necessary to avoid confusion.[8] Aronson *et al*. in their work, have utilized verbal description while performing the demonstration.[12] We also used verbal descriptions to explain the steps in examining a patient with third nerve palsy to both Groups. Only the Study-Group was exposed to modelling demonstration. The Control-Group showed poor post-test results, almost the same as the pre-test. The total mean score given by all observers in the post-test of the Study-Group was 92.07±13.128, which was statistically significantly different from the mean score of 74.53±12.839 given in the Control-Group post-test (*p*-value 0.0001).

Our results validate that role modelling is more beneficial in learning medical students than formal teaching methods.[13] While some have argued against role-modelling as a didactic teaching strategy that encourages imitation and dependence, others believe it meets an important need for students to witness role models in action and study the activities that constitute their effectiveness. This is especially true for novices, who seek confidence, direction, guidance and motivation through their learning stages. It is beneficial even at advanced levels of learning.[14-16] This was probably why we did not experience any dropouts or absentees.

Although most contemporary literature mentions role modelling as a means of imparting change in knowledge, skills and attitude, emphasis has been laid mostly on values and professionalism. Some authors, while using the word 'role-modelling' or 'modelling', refer to the demonstration of skills and behaviour, with

conscious involvement of both teacher and student, to achieve specific outcomes.[17,18] Warren Haston, a renowned music teacher, in his article, reported the use of modelling successfully to introduce new musical concepts and performance skills on musical instruments before students learn about printed music.[19] We have given more scope to delivering clinical skills and some affective domains. Certain points in the checklist were purely addressing clinical skills, whereas the steps related to greeting, thanking, and concern for pain and counselling. However, clinical skills had aspects concerned with attitude and professionalism. The change in the overall post-test result in our study had a general improvement in all categories or steps.

Recent literature has been keen on trying out video-recorded sessions of modelling. Alqahtani *et al*. in their study, used both live modelling to demonstrate clinical skills and video recording of the same. It was a comparative study which proved both methods as equally effective. However, it showed a preference amongst students for live demonstrations or modelling. 59% of the students in the Live Demonstration Group preferred the teaching method they received compared to 40% in the Video Group. Similarly, 35% in the latter did not favour their given method as compared to only 18.18% in the former.[20] Similar findings have been reported by Bayzik *et al*. and Packer *et al*. Students in these studies claimed they got more opportunities to ask questions and interact with their preceptor in live modelling. They also experienced increased confidence and improved communication skills and overall understanding.[21,22]

Pre and post-tests are particularly helpful in analyzing student performance quantitatively after the designed intervention.[23] We, therefore, decided to use pre and post-test for data collection in our study. The pre-test and post-test methods of assessment were convenient as well as informative. Various assessment methods can be used in a pre and post-test, however, we used a simple but comprehensive checklist with a Lickert scale of 1 to 5.

The pre and post-tests allowed us to gather baseline data regarding the skills students had prior to enrolment for the study and then, enabled us to compare that to the level of skills two weeks after the modelling session.

Assessment holds key value in an instruction design. It tells us not only about the learning that is taking place but gives valuable feedback for improvement of the strategies.[14] Despite the strong linkage between assessment and instruction, the pre-and post-test method remains underexplored. Swoger has given special focus to it in her article, "Closing the Assessment Loop Using Pre- and Post-Test Assessment", exhibiting a special emphasis on the use of pre and post-test in the development of a one-shot instructional intervention.[24]

Aaronson *et al.* in their pilot study used a 40 minutes role modelling intervention through video demonstration combined with verbal reinforcement of expected behaviours. Student performance was shown to improve by 47%. She, however, demonstrated a negative correlation between the number of days after the role modelling intervention and the post-test results.[12] Although more research is required to decide on the right time for post-test, it can be done immediately after an intervention to up to after the whole duration of a course.[25] As our batches were with us for two weeks only, we performed the post-test on the last day after conducting the pre-test and the modelling demonstration on the first day.

The checklist was handed over to three examiners of almost equal ability to assess the students. The same assessors took all the pre and post-tests for both Groups. Multiple assessors were used to enhancing reliability. It was confirmed by applying ANOVA, where the difference in mean scores given by the three observers was found to be statistically insignificant.

CONCLUSION

Role-modelling or modelling as a means of demonstrating clinical skills and professional behaviour is effective as a teaching or instructional strategy, as measured through pre and post-test assessment methods. Conscious adoption and utilization of this technique can enhance student learning by giving them direction and supporting increased student-teacher interaction.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

FAKN: Data acquisition, data analysis, data interpretation, drafting the manuscript, critical review, approval of the final version to be published, TK: Conception, study design, cri-tical review, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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