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RESEARCH ARTICLE
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DEVELOPING TEACHING COMPETENCE IN POSTGRADUATES: A PILOT STUDY IN PHYSIOLOGY PRACTICAL TRAINING FOR UNDERGRADUATES

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Abstract

Background It is an established practice, in most medical colleges in the country, that post-graduate [PG] residents of any department teach the practical lessons in the laboratory to the under-graduate [UG] students. However the PG students do not have any formal training in imparting teaching.

Aim: To ascertain the benefits of Training the PG students in Teaching Techniques, a pilot study was conducted.

Objectives

a. Comparison of teaching performance of a First year Post Graduate resident before & after training.
b. Comparison of performance of Under Graduate students taught by the First year PG resident before & after the training
c. Comparison of performance of UG students taught by the subject after training with the performance of students taught by the Control (conventionally trained second year PG resident).
d. Self-appraisal by the First year PG resident

Results: Observations of our pilot study revealed that training the Post Graduate resident helps not only in improving his performance but also the performance of the end beneficiary- the under graduate students, in under graduate physiology practical classes. It is desirable to make this a part of Post Graduate training in Physiology and other disciplines of Medicine.

Keywords: Training, physiology, post graduate students, medical education

Introduction:

In medical education, teaching proficiency is a fundamental prerequisite for both seasoned faculty members and postgraduate students who act as mentors and role models for undergraduates. Postgraduates regularly oversee practical sessions in medical schools, particularly in the field of physiology, greatly enhancing the academic and professional growth of undergraduates. Physiology places a strong emphasis on practical training since it is crucial for connecting theoretical ideas with real-world application, honing psychomotor skills, and developing crucial clinical attitudes. Excellent teaching techniques in these hands-on sessions can improve students' educational experiences, strengthen fundamental physiological concepts, and influence their future clinical reasoning.[1,2]

Post graduate training for the degrees of MD/MS in the Medical College is for a period of three years. Post Graduate (PG) residents, in Physiology, during the training period have the additional responsibility of teaching Under Graduate (UG) MBBS students in Practical classes. However, no 'formal training' is provided to them to undertake this task. They learn by observing the teaching done by senior PG residents, self study and informal discussion with senior PG and faculty.[3] Many postgraduates receive little formal training in pedagogy, resulting in disparities in teaching effectiveness. Developing core teaching competencies—including lesson planning, communication abilities, classroom management, and the use of audiovisual aids—enriches postgraduate instructors, making them more effective educators and health communicator.[4] Hence, conducting this pilot study is important.

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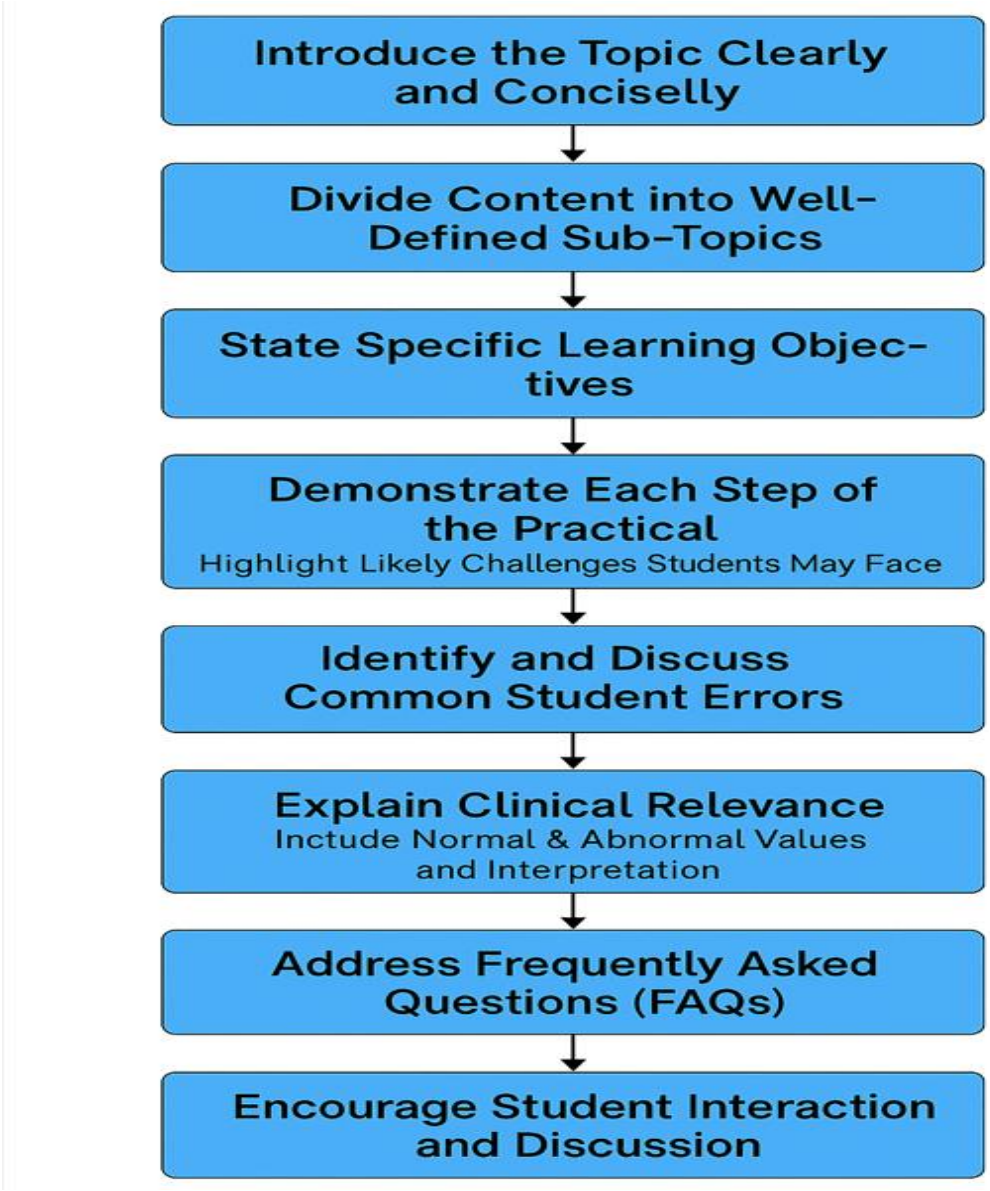
Method

This study was conducted in Government. J.L.N Medical College , Ajmer , Rajasthan for a period of 6 months between July 2024 to December 2024. The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from the participants. A first-year postgraduate (PG) resident was designated as the intervention (test) subject, while a second-year PG resident, trained through conventional methods, served as the control. The second-year resident had acquired teaching skills during the first year of training through traditional, informal means—primarily by observing senior residents, engaging in self-directed learning, and participating in unstructured discussions with peers and faculty. No formal pedagogical training was provided. In contrast, the first-year PG resident underwent a structured training program designed to prepare them for conducting undergraduate physiology practical classes. The structured approach included the following components:



This structured training aimed to enhance teaching clarity, student engagement, and contextual relevance in physiology practical sessions.

Study design

The undergraduate (UG) batch was routinely divided into two subgroups—Batch A and Batch B—for practical sessions, with each group attending on separate days for two hours per week.

a. Initial (Control) Session:

The second-year postgraduate (PG) resident (serving as the control) conducted a session on Total Red Blood Cell (TRBC) Counting (Practical 1) for Batch A. Following the session, Batch A students performed the practical. Their performance was evaluated by faculty members using a pre-designed structured assessment format.

b. Pre-Training Assessment of Test Group:

The teaching performance of the first-year PG resident (Test) was evaluated by faculty members using a structured observation checklist, during a session on TRBC Counting (Practical 1) for Batch B. In addition, the performance of Batch B students—taught by the untrained first-year PG resident—was similarly assessed using the same evaluation format.

c. Training Intervention:
The first-year PG resident then underwent structured pedagogical training as described earlier, facilitated by the principal investigator.

d. Post-Training Assessment – Control Group:
To minimize bias, the student batches were interchanged for the post-training phase. The second-year PG resident (Control) conducted a session on Total White Blood Cell (TWBC) Counting (Practical 2) for Batch B. The faculty again assessed student performance using the same structured format applied in the pre-training phase.

e. Post-Training Assessment – Test Group:
The trained first-year PG resident conducted the TWBC Counting (Practical 2) session for Batch A. Both the teaching performance of the resident and the performance of the Batch A students were evaluated by the faculty using the same structured assessment tool.

PG Student	UG Batch A	UG Batch B
1. Second Year PG resident	Practical 1 (TRBC)	-
2. First Year PG resident (Before Training)	-	Practical 1 (TRBC)
3.First Year PG resident (After Training)		Practical 2 (TWBC)
4. Second Year PG resident	-	Practical 2 (TWBC)

Legned: TRBC: Total Red Blood Cell Counting, TWBC: Total White Blood Cell Counting, PG - Postgraduate Resident, UG - Undergraduate Student

Table 1: Showing the study design for teaching the practicals.

Evaluation:
The impact of the structured training program was evaluated through a multi-faceted evaluation approach involving both the postgraduate (PG) resident and the undergraduate (UG) students. The following methods were employed:

1. Pre- and post-training comparison of the teaching performance of the first-year PG resident, to assess improvement following the structured intervention.
2. Pre- and post-training comparison of undergraduate student performance, based on assessments conducted before and after being taught by the trained first-year PG resident.
3. Comparative analysis of the performance of undergraduate students taught by the trained first-year PG resident versus those taught by the control group (a second-year PG resident trained through conventional, informal methods).
4. Self-appraisal by the first-year PG resident to reflect on perceived growth in teaching skills, confidence, and overall effectiveness after the structured training.

Results & Analysis:
1. Comparing PG Teaching Performance Before and After Intervention:
The table presents a detailed comparison of the postgraduate resident's (PG) teaching performance before and after receiving structured training. The evaluation was based on several key teaching

parameters in the Total Red Blood Cell (TRBC) Counting Practical, with each item assigned a score. A paired t-test was conducted to assess statistical significance. Parameters such as neubauer chamber, name of the reagent and calculations show significant improvement. The rest of the parameters showed non-significant changes. This is shown in Table 2.

Table 2

Comparison of PG Assessment before and after intervention: Result of paired 't' test

Parameter with marks	**Before Intervention**		**After Intervention**		**t' statistics**	**p-value**
	Mean	**SD**	**Mean**	**SD**		
Aim of the Experiment (1)	1.00	0.00	1.00	0.00		
Principle of the Experiment (2)	1.33	0.58	2.00	0.00	-2.00	0.18
Apparatus used						
(a) RBC Pipette (2)	2.00	0.00	1.00	0.00		
(b) Neubauer Chamber (1)	0.33	0.58	3.00	0.00	**-8.00**	**0.02**
(c) Use of Microscope (1)	0.00	0.00	3.00	0.00		
Reagent Used						
(a) Name of the Reagent (1)	1.00	0.00	2.67	0.58	**-5.00**	**0.04**
(b) The contents (2)	1.67	0.58	1.33	1.15	0.38	0.74
(c) The functions of the content	2.00	0.00	1.33	1.53	0.76	0.53
Procedure						
(a) How to draw blood in the pipette (2)	1.67	0.29	2.67	1.15	-1309.00	0.32
(b) How to draw diluting fluid in the pipette (2)	2.00	0.00	1.67	0.58	1.00	0.42
(c) What is the quantity of diluting fluid taken? (1)	1.00	0.00	2.00	0.00		
(d) The precautions (3)	2.00	0.50	1.00	0.00	**3.46**	**0.07**
(e) How to charge the chamber? And the precautions (3)	2.00	0.50	0.67	0.58	**3.02**	**0.09**
How to focus under the microscope? (3)	1.00	1.00	1.00	0.00	0.00	1.00
The procedure of counting						
(a) Which counting chamber to be used ? (2)	2.00	0.00	2.00	0.00		
(b) How to count RBC in a given square? (3)	3.00	0.00	2.00	0.00		
Calculations (4)	3.50	0.50	2.00	0.00	**5.20**	**0.04**
Discussions						
(a) of Normal values(2)	1.67	0.58	1.33	0.58	1.00	0.42
(b) Variations: Physiological and Pathological (4)	3.67	0.58	3.67	0.58		
(c) Frequently asked questions (3)	1.67	0.58	1.00	1.00	1.00	0.42
Explain the method of recording the practical (6)	0.00	0.00	6.00	0.00		

The bold values are significant at 5%level of significance

Significance level :

The P -value less than or equal to 0.05 indicates the significance at five percent level of significance

The P -value less than or equal to 0.01 indicates the significance at one percent level of significance

2. Comparison of Undergraduate (UG) Student Performance Before and After PG Resident Training

This table compares the performance of undergraduate students taught by a first-year postgraduate (PG) resident before and after the resident received structured teaching training. The analysis was conducted using the independent t-test, and the performance was measured across several key skill areas in a hematology practical session. The students included **Under Graduate students** (Batch A- Practical 2; n=19) and (Batch B- Practical 1; n=24) on practical taught by the same **First year PG resident trained conventionally**. Highly Significant Improvements ($p < 0.001$) were noted in:- Calculation, Method of Recording, and Total Score — indicating substantial learning benefit attributable to improved teaching quality post-training. The details are shown in Table 3.

Table 3

Result of t- test - Comparison of UG performance (Taught by PG 1st year) before and after training

Parameter (Maximum marks)	PRE TRAINING			POST TRAINING			P -Value	t' statistics
	N	Mean	SD	N	Mean	SD		
Pipe ting (5)	24	2.83	1.63	19.00	2.89	1.88	0.91	0.11
Charging the Chamber (5)	24	2.42	1.44	19.00	3.32	1.83	0.78	1.81
Focusing under Microscope (5)	24	3.13	1.48	19.00	4.21	1.13	0.01	2.635**
Counting (5)	24	4.04	1.46	19.00	4.79	0.42	0.04	2.16**
Calculation (5)	24	2.69	1.94	19.00	4.63	0.76	**0.00**	**4.109*** **
Method of Recording (5)	24	1.96	1.57	19.00	4.26	1.15	0.00	5.352***
Questions (5)	24	3.79	1.29	19.00	4.26	1.07	0.21	1.28
Total (35)	24	20.56	4.97	19.00	28.37	5.74	**0.00**	**4.776*** **

** significant at Percent level 1% of probability

*** significant at Percent level 5% of probability

3. Comparison of Undergraduate (UG) Performance Taught by PG 2nd Year vs Trained PG 1st Year Resident

This table compares the performance of undergraduate students taught by Untrained PG 2nd-year residents vs Trained PG 1st-year residents (who received structured teacher training. The performance of **Under Graduate students** [Batch A –Practical 2; n=19] showed statstically significant improvement (p value <0.05, independent t-test) on the practical taught by **First Year PG resident after training** as compared with their performance [Batch A –Practical 1; n=15; 4 students from original batch were absent] on the practical taught by **conventionally trained Second year Post Graduate resident.** The comparison was made using an independent t-test, assessing several core procedural and cognitive skills relevant to a hematology practical session**.** This is shown in Table 4.

Impact on UG students' learning (Table 4):

Table 4

Result of t- test - Comparison of UG performance (Taught by PG 2nd year and Trained PG 1st year)

Parameter (Maximum marks)	TAUGHT BY PG 2ND YEAR			TAUGHT BY PG 1ST YEAR			P - Value	t' statistics
	N	Mean	SD	N	Mean	SD		
Pipetting (5)	15	2.10	1.76	19.00	2.89	1.88	0.22	1.26
Charging the Chamber (5)	15	2.23	1.71	19.00	3.32	1.83	0.09	1.76
Focusing under Microscope (5)	15	4.13	0.74	19.00	4.21	1.13	0.82	0.23
Counting (5)	15	3.80	1.65	19.00	4.79	0.42	0.02	2.529**
Calculation (5)	15	2.83	1.33	19.00	4.63	0.76	**0.00**	**4.96*** **
Method of Recording (5)	15	1.87	1.96	19.00	4.26	1.15	0.00	4.461***
Questions (5)	15	2.93	0.62	19.00	4.26	1.07	0.00	4.262***
Total (35)	15	19.90	4.76	19.00	28.37	5.74	**0.00**	**4.598*** **

*** significant at Percent level 1% of probability

** significant at Percent level 5% of probability

4. Comparison of UG Student Performance (Taught by Trained PG 1st Year vs PG 2nd Year)
This table presents the results of an independent t-test comparing the performance of undergraduate (UG) students taught by: A trained PG 1st-year resident, and a PG 2nd-year resident (without formal teacher training). Impact on UG students' learning (Table 5): The performance of **Under Graduate students** [Batch A –Practical 2; n=19] showed statistically significant improvement (p value <0.1, independent t-test) on practical taught by **First Year PG resident after training** as compared with performance of Under Graduate students [Batch B –Practical 2; n=18(6 students from original batch were absent)] on practical taught by **conventionally trained Second year Post Graduate resident.** This is shown in Table 5.

Table 5: Comparison of Performance of UG students- Result of Independent t- test

Parameter (Maximum marks)	TAUGHT BY TRAINED PG 1ST YEAR			TAUGHT BY PG 2ND YEAR			Mean difference	t' statistics
	Mean	N	SD	Mean	N	SD		
Pipetting (5)	2.89	19	1.88	3.61	18	1.82	-0.72	-1.18
Charging the Chamber (5)	3.32	19	1.83	3.33	18	1.88	-0.02	-0.03
Focusing under Microscope (5)	4.21	19	1.13	2.83	18	1.04	1.38	3.838*
Counting (5)	4.79	19	0.42	3.94	18	1.73	0.85	2.066*
Calculation (5)	4.63	19	0.76	4.00	18	1.08	**0.63**	**2.06***
Method of Recording (5)	4.26	19	1.15	3.83	18	1.38	0.43	1.03
Questions (5)	4.26	19	1.07	4.11	18	1.13	0.15	0.42
Total (35)	28.37	19	5.74	25.67	18	5.54	**2.70**	**1.56****

* significant at Percent level 5% of probability

** significant at Percent level 10% of probability

5. Self-appraisal by the First year PG resident after training done on Likert scale showed that a score of 4 on a scale of 5 in four out of five parameters taken for evaluation. The trained first year PG resident agreed with the following statements: The PG resident benefited from the intervention, felt more competent in dealing with the students, and acquired skills to perform the practical and

gained knowledge. This further indicates that even the subject (PG resident) felt an improvement within himself.

Discussion

This pilot study shows that postgraduate (PG) residents who get organized teaching training can increase undergraduate (UG) students' learning outcomes in physiology practical and the effectiveness of their instruction in quantifiable ways. Our results are consistent with an increasing amount of research demonstrating the importance of formal teacher preparation in medical education, especially for residents who are taking on more responsibility for instructing undergraduates.[5,6] The structured intervention resulted in statistically significant improvements in several aspects of the first-year PG resident's teaching performance, particularly in areas such as explaining the Neubauer chamber, reagent identification, calculations, and practical recording methods. These improvements suggest that targeted pedagogical training can address specific gaps in teaching skills that are often neglected in conventional, observation-based learning. There have been previous several studies which have shown that even brief, structured training can enhance residents' confidence, clarity, and ability to engage students.[7]

In this study, while comparing the students taught by the trained first-year PG resident to those taught by the untrained resident, the former demonstrated notable improvements in three important practical skills: calculation, recording technique, and overall practical performance. These results are in line with research showing that teacher preparation programs can have a real positive impact on students' learning. [8,9] The importance of systematic education in promoting best practices in laboratory work is demonstrated by the fact that the most noticeable gains were observed in procedural and documentation abilities. In accordance with the World Federation for Medical Education's recommendations[10], which support the inclusion of teacher training in postgraduate medical curricula, the consistently superior performance of the trained PG resident's students, even when compared to those taught by a more experienced but untrained resident, highlights that teaching competence is a distinct and trainable skill set, not just a byproduct of clinical experience. The crossover study design, in which student batches were reassigned to different instructors post-intervention, was effective in minimising bias and isolating the effect of the training intervention.

Limitations

The study has a few limitations. The results' generalisability may be impacted by the small sample size, which consisted of only one PG resident and two UG cohorts. Furthermore, the impact of the intervention was evaluated within a brief time frame; longitudinal research is required to ascertain whether the advantages are maintained. The study's findings might not be immediately applicable to other physiology or medical education courses because it concentrated on hematology practicals. Nonetheless, the favourable results are consistent with the larger body of research on the effectiveness of teacher preparation in medical education, indicating that comparable approaches might be advantageous in other settings.

Conclusion

This pilot study demonstrates that structured pedagogical training significantly enhances the teaching performance of PG residents and, more importantly, positively influences UG student learning outcomes in physiology practical sessions. The results underscore the critical need for formal teaching skills training in postgraduate medical education, as even a brief, targeted intervention led to measurable improvements in teaching effectiveness and student performance. These findings reinforce the view that teaching is a distinct and trainable competency, not merely a function of clinical seniority or experience.The study aligns with global recommendations, such as those of the World Federation for Medical Education (WFME), which advocate for integrating faculty development and teaching training into postgraduate medical curricula. Although the limited sample size and short follow-up period restrict broader generalizability, the promising results highlight the potential impact of implementing structured teacher training programs at an institutional level. Future studies with larger cohorts and longer durations are warranted to confirm

these findings and support curriculum reforms that systematically prepare PG residents for their essential role as medical educators.

References:

1. Hüzmeli İ, Katayıfçı N. Importance of Physiology Education in Physiotherapy and Rehabilitation. J Basic Clin Health Sci. 2021;7(2):693-704.
2. Savitha D, Taniya A. Student perceptions of “doing” hematology physiology practicals. Adv Physiol Educ.2020.
3. Ayodele OE, Blitz J. Residents-as-teachers: A Needs Assessment of Residents' Teaching Skills in the Clinical Setting Using Direct Observation of Teaching. West Afr J Med. 2024;41(2):215-25.
4. Deshpande SR, Shastri S. A cross-sectional study to evaluate teaching skills of postgraduate medical students using component skill approach in microteaching. J Educ Health Promot. 2020;9:362.
5. Sawatsky AP, Ratelle JT, Beckman TJ. Qualitative research methods in medical education. Anesthesiol. 2019;131(1):14-22.
6. Irby DM, Cooke M, O’Brien BC. Calls for reform of medical education by the Carnegie Foundation for the Advancement of Teaching: 1910 and 2010. Acad Med. 2010;85(2):220-7.
7. Morrison EH, Hafler JP. Yesterday a learner, today a teacher too: residents as teachers in 2000. Pediatr. 2000;105(1 Pt 3):238-41.
8. Johansson J, Skeff K, Stratos G. Clinical teaching improvement: the transportability of the Stanford Faculty Development Program. Med Teach. 2009;31(8):e377-82.
9. Prideaux D, Alexander H, Bower A, Dacre J, Haist S, Jolly B, et.al. Clinical teaching: maintaining an educational role for doctors in the new health care environment. Med Educ. 2000;34(10):820-6.
10. World Federation for Medical Education. WFME Global Standards for Quality Improvement: Basic Medical Education. 2020 [cited 2025 Jul 19]. Available from: https://wfme.org/standards.