e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(8); 1317-1328

Original Research Article

A Mixed Method Survey Study on Perspectives of Physiology Electives by Students and Teachers

Sanhita Mukherjee[1], Debalina Sengupta[2], Lekha Biswas[3], Goutam Banerjee[4], Alka Rawekar[5]

[1]Professor, Department of Physiology, Rampurhat Govt. Medical College, Rampurhat, Birbhum, West Bengal

[2]Associate Professor, Department of Physiology, Rampurhat Govt. Medical College, Rampurhat, Birbhum, West Bengal

[3]Associate Professor, Department of Biochemistry, Rampurhat Govt. Medical College, Rampurhat, Birbhum, West Bengal

[4]Associate Professor, , Department of Physiology, East west institute of medical Science and Research

[5]Professor & HOD, , Department of Physiology, Jawaharlal Nehru Medical College Sawangi (M) Wardha Maharashtra, India, DMIHER-DU

Received: 01-05-2025 Revised: 15-06-2025 / Accepted: 21-07-2025

Corresponding author: Dr. Alka Rawekar

Conflict of interest: Nil

Abstract

Introduction: Elective modules are inherent to medical education, promoting problem-solving, self-directed learning, and clinical skills. This study explored perceptions of students and faculty regarding Physiology electives—Electrocardiogram (ECG) and Pulmonary Function Test (PFT)—and assessed their impact on knowledge gain.

Methods: A mixed-methods study was conducted at Rampurhat Government Medical College, West Bengal, among 30 MBBS students of the 2022 batch. Participants selected ECG or PFT electives. Data were collected through pre- and post-tests, a Likert-scale survey, and focus group discussions. Paired t-tests analyzed quantitative data, while qualitative responses underwent thematic analysis.

Results: Post-test scores significantly improved (p < 0.05). Students appreciated hands-on training, diagnostic skills, and communication. Faculty complimented student involvement but pointed out short duration as a limitation.

Conclusion: Well-structured Physiology electives upgrade knowledge and clinical readiness, supporting their continued inclusion in the MBBS curriculum.

Keywords: Physiology Electives, Perception By Students And Faculty, Impact On Knowledge Gain.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0) and the Budapest Open Access Initiative (http://www.budapestopenaccessinitiative.org/read), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

An elective or 'optional' course is generally a short duration course, which is not compulsory, and in which the student has the chance to 'elect' (select) depending on his/ her own interest from numerous accessible options of courses [1]. Elective courses are fundamental of medical curriculum in many universities worldwide. Many studies have proclaimed the benefits of electives like enhanced knowledge and skills, escalated critical thinking and problem-solving skills, improved communication and teamwork skills, augmented self-confidence and motivation, a more versatile education, opportunity for investigative learning, lateral thinking, immersive learning, and progress of spirit of enquiry [2-7]. Electives have been presumed to promote trans- formative learning [8]. Therefore, the incorporation of electives in medical degree curricula is of flourishing significance. National Medical Commission (NMC), India is a body that plans curriculum for the undergraduate medical students of India. A new Competency Based Undergraduate Curriculum for the undergraduate medical students has been ushered in by NMC from the year 2019. In this new curriculum, NMC has initiated Elective module for the first time in India. In accordance with the NMC guidelines, an Elective is a zone or a course that as specialty will allow the students to learn and reconnoitre something unique. Even super-specialty departments (which are not involved in undergraduate teaching) can contribute Electives. The total duration of Elective is one month divided into two blocks (Block 1 and Block 2) each having duration of fifteen days. Students will have to opt

for from Electives offered by Pre- and Para-clinical departments (Anatomy, Physiology, Biochemistry, Pathology, Microbiology, Pharmacology, Forensic Medicine and Toxicology) in Block 1 and Clinical (broad speciality), Super-speciality departments, and Community clinics (rural/urban) in Block 2.

Presently, MBBS students go through four Phases while enduring their training. Phase I (pre-clinical) starts with the entry to the medical college followed by Phase II, Phase III (Part I), and finally Phase III (Part II). Electives are imparted at the end of Phase III (Part I) and before the beginning of Phase III (Part II). The integrated list of Electives being rendered by the institutes is furnished to all the students well in advance. Every Elective requires having specific learning objectives, well organized plan of its implementation, a logbook and an assessment at the end. Every elective can have only a fixed number of students that can be trained in that Elective. This number is to be settled by the speciality offering that Elective. Students have to choose Electives from the list provided. The additional method of assigning Electives to the students is to be determined by the institute. Electives can also be chosen in an outside Institution [9,10,11,12].

Reed et al in their review of medical education demonstrated13"Exploring the complex, developmental nature of the speciality choice process is key to both understanding how specialty decisions are made and ultimately improving the decision making process. Because this is an area that has not been researched widely, there are ample opportunity researchers to fill this gap in our knowledge".

Basic science and clinical syllabus both prevail the strongest basis of medical curriculum. But little is known about the concern of students about the electives allotted to basic science departments like Physiology.

Department of Physiology in our institute was allotted two elective topics. 1. Pulmonary function test and 2. ECG or Electrocardiography.

Aim: To evaluate the impact of Physiology electives on knowledge enhancement among MBBS students, and to explore perceptions, strengths, limitations, and improvement strategies from both students and faculty through a mixed-methods approach.

Objectives: Quantitative Objectives: To measure the change in students' knowledge through pre- and post-test scores.

Qualitative Objectives:

- To explore in-depth perceptions of students and faculty regarding the educational value, relevance, and implementation of the electives.
- To identify perceived strengths, limitations, and barriers associated with the ECG and PFT modules.
- To gather suggestions for improving the structure and content of the Physiology electives
- To integrate findings through methodological triangulation of quantitative and qualitative data for comprehensive insight.

Methods

The present study was carried out in a medical college of West Bengalamidst30 MBBS students' of 2022 batch (admission year 2022), the third batch that underwent the new addition in MBBS curriculum, i.e., the electives program, who took PFT (n=15) and ECG (n=15) as their electives. This study was sanctioned by the institutional ethics committee.

Research Question: Do Physiology electives enhance knowledge acquiring among MBBS students, and how are these electives perceived by students and faculty in terms of strengths, challenges, and opportunities for improvement?

Null Hypothesis (H0): Implementation of Physiology electives (ECG and PFT) has no significant effect on the knowledge gain of undergraduate medical students, and students' and faculty perceptions do not differ from neutral regarding their strengths, limitations, or educational value.

Alternative Hypothesis (H1): Implementation of Physiology electives (ECG and PFT) significantly improves the knowledge gain of undergraduate medical students, and both students and faculty report positive perceptions regarding their strengths, educational value, and areas for improvement.

Study Design: This is a mixed method, questionnaire-based study. The current study followed parallel mixed method design [14,15,1] with an initial quantitative survey of pre-test/post-test score and study of perception using a pre-validated questionnaire followed by a qualitative study by focused group discussion (FGD).

This approach helps to guide the discussion questions for the focused group and corroborate the findings of the survey, thus providing for the methodological triangulation and greater rigor to the study [17,18].

Study duration: November 2024 to September 2025

Study area/ setting: Physiology department, Rampurhat Govt. Medical College

Study population: Whole30 students who took PFT and ECG as elective

Inclusion criteria: All 30 students who took PFT and ECG as elective.

Exclusion criteria: If any student does not give consent or absent.

Sampling technique: Sample size formula is n = (Z^2 * p * (1-p)) / d^2, where 'n' is the required sample size, 'Z' is the Z-score (e.g., 1.96 for 95% confidence), 'p' is the estimated prevalence, and'd' is the desired margin of error. Based on a 5% margin of error, a 95% confidence level, and a 1% outcome response, the estimated sample size was 16 students, where the population was 3000 students. (Total number of students under WBUHS eligible for electives including rural and urban medical colleges)

Sample size of present study: 30

Study Design

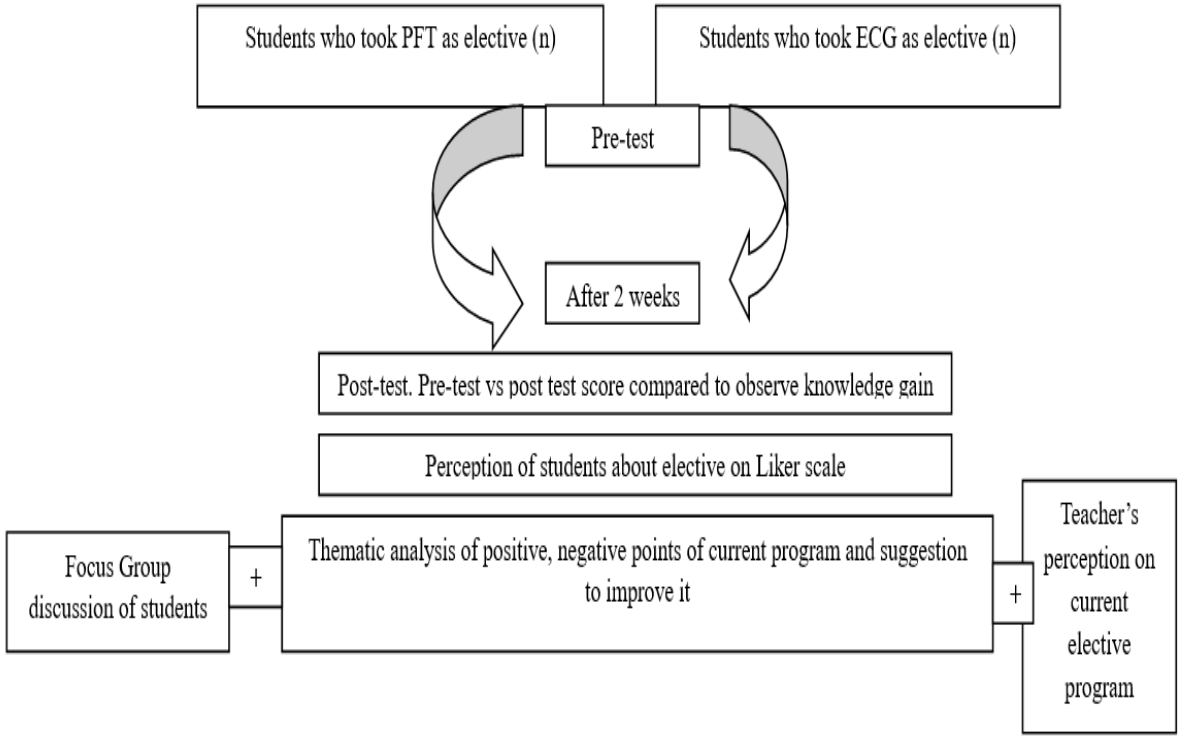


Chart 1:

Study module

ECG program Schedule		**PFT Program Schedule**	
Week 1	**Week 2**	**Week 1**	**Week 2**
Pre-test	Performing ECG by own and interpret PR interval, Heart rate, Cardiac Axis	Pre-test	Perform PFT on patient under supervision (at least 2 each sudent)
ECG introduction	Overview of Arrhythmia and abnormal ECG	PFT-Theory introduction	Overview of reversibility test
Lead Placement	Post test		Interpretation of spirometry result
Doing ECG on healthy subjects (Correct lead placement and attitude & communication with subject)		Observation of procedure and explain the procedure to the patient	Post test
Maintenance of privacy of female patients		Weight, height measurement, history taking and data entry at software	
Students have to maintain a logbook and details of patients they performed by their own. Each group gave a power-point presentation and scoring will be given as a part of formative assessment.			

After explaining the purpose of the study and taking informed consent, online survey was conducted. It was done with a validated questionnaire which was developed by the author after a series of students' and staff focus group discussions. It was validated by three experts in the field of medical education. The questionnaire was sent to the students who took part in the 2-week electives in 2025 via Google documents.

Focus Group Discussion (FGD) – To further strengthen the findings of the study, two FGDs – one for each batch – was also be conducted. Informed consent was obtained from each of them before the start of FGD.

Study instrument for recording knowledge gain by students on completion of 4 weeks electives: The students were assessed immediately prior to and shortly after their elective experience by pretest & posttest questionnaire on PFT and ECG as prepared by the subject experts of physiology department. This assessment was done to compare the knowledge gained by the students after doing 2 weeks' electives in the Physiology department.

Study instrument for recording perception on electives: To study the perception of students and teachers on electives, an online survey with validated questionnaires (validated by three experts in the medical education field) was used. The questionnaire was sent to the students who took part in the 2-week electives in 2025 via Google documents. The survey was instituted in collaboration with experts in medical education and medical students involved in the elective.

The anonymous, self-administered, English language questionnaire was used with 12 survey items for gathering the participants' answers. Out of the total 12 items, there was2 items, for demographics; 10 items seeking students' responses on a 5-point Likert scale from strongly agree to strongly disagree, 1 item concerning mainly about reason they took PFT and ECG as elective; and, 3 items was open-ended question, asking participants for their opinion on strength and weakness of this program and their suggestions to improve it. An online Google form was used to create the questionnaire, and all participants was sent the link via email and a WhatsApp group. All academic members who answered the questionnaire, their answers were used for data analysis.

To further strengthen the study two FGDs – one for each batch –was carried out to gather qualitative data using open-ended questions. Focus groups were formed randomly with 10 students each from ECG and PFT electives. Discussions for each group were scheduled as separate one-hour sessions.At the time of focus group discussions, we obviated questioning the participants and letting them reply to the questions one by one. We made our participants easy-going to non-concur with each other (if any) and voice their conviction by group discussions. Our aim was to make reciprocity among the participants. The final questioning route comprised of the following questions:

- What is your feel related to elective modules during your training days?
- What are the impediments rooted in the modules?
- Are there any ways to surmount these difficulties?

The session was audio-recorded and decoded by one of the members of the research team. Analytical process started by using verbatim transcription and recognizing the participants' impressions. Participants were informed of the session being recorded, and verbal informed consent to the audio taping was procured from all participants. They were fully autonomous and had the liberty to leave the study as they preferred. The objectives of the focus group were explicated at the commencement of the session. Participants were pledged that the procured information would not be used for any purpose except the research and their identification would remain private.Two such focused group discussions were conducted by which time the data saturation point was reached, and no further new concepts and ideas appeared in the responses of participants [19]

A qualitative content analysis was executed according to Graneheim and Lundman [23]. In this context, the transcript was read meticulously and repeatedly to attain an overview of what was talked over during the discussions and accentuate the similar phrases or words associated with the study objective (identifying units of data). The unit of analysis, which is crucial in a content analysis, is a "segment of text that is comprehensible by itself and contains one idea or piece of information" [24].

Subsequently, each data unit was condensed and allocated a code. Similar and different codes were labelled and amalgamated, if practicable. Then, categories aroused by grouping the codes (meaningful units) stating similar or different idea. At last, we employed a general theme for the arose categories.

All transcripts were autonomously coded by two researchers, administering as many codes as feasible for each data segment. All coding and categories recognized were arranged with research members to confirm inter-rater reliability. Any obscurity or conflict concerning the coding were fixed by exchange between two coding researchers and in the case of not reaching unanimity, a third member of the research team was mediated.

As every qualitative research, our study reinforces and complies to quality criteria of credibility, transferability, dependability, and conformability. To meet credibility, researchers had diverse field experience and sustained commitment in all processes of the study. In addition, the procedure of data collection and analysis were scrutinized and reviewed by the research team. With reference to transferability, researchers attempted to furnish full narrative of the context of the study. We also undertook to have sufficient talk regarding the outcomes with already published works. It should be observed that examining several frames of reference and the handling of direct quotations during the delineation of observations all assisted with transferability of the study. For dependability, we followed the code recode approach. From this perspective, we coded our data twice by two members of the research team. We then matched data to see if any disparity were recognized. As regard conformability, a qualitative research specialist was solicited to check the coding and analysing processes.

Data triangulation was achieved through multiple data sources. Investigator triangulation will occur because of the incorporation of different disciplinary perspectives into the data analysis. Member checking was conducted at the end of each focus group by checking our perceptions of the main points of the session with participants.

Data Analysis: Microsoft Excel 2007® was used for data entry and statistical analysis. Thematic analysis was used to examine the qualitative data, and proportions were reported as percentages.

Data analysis of FGD - Every member of the analysis unit reviewed each group transcript separately and noted key words, phrases, and major themes, both in response to the specific questions asked and as they spontaneously emerged from student comments.

The responses was then entered into an Excel database with each sheet in a file being used for each question of FGD. The coding column was filled during the next phase of analysis where the categories will be synthesized both by deductive and inductive process.

Results

Out of 30 students who took ECG and PFT as elective, 14 were male (46.66%) and 16 (53.33%) were female. Mean± SD of their age was 23 ±1.18 years. Their attendance was 100%. ECG and PFT was their 1st choice among all Block 1 topics in 26 (86.66%) students and was 2nd choice in 4 (13.33%) students. This demographic pattern was depicted in Table 1.

Figure 1 shows the pre-test and post-test score distribution of both ECG and PFT. The Q-Q plot, Shapiro-Wilk test (p value 0.1422) and Kolmogorov-Smirnov test (K-S test statistics D 0.16)results indicate that both pre-test and post-test score are normally distributed ($p > 0.05$). Therefore, the appropriate statistical test for comparing the means between these two independent groups is the Independent Samples t-test.

Table 2a demonstrates the paired t test result of combined ECG and PFT scores. It depicts, there is significant increase in knowledge of students in both ECG and PFT after completion of electives with p value of 0.0014*.Table 2b shows the individual comparison between pre-test and post-test scores of ECG module. Likewise in this case too significant p value of 0.0038 was obtained that illustrates knowledge gain. Table 2c exemplifies the comparison between pre-test and Post-test scores of PFT module. A p value of <0.05 (0.000016) signifies substantial knowledge gain in this regard as well.

Majority of students of both ECG and PFT electives agreed that the objectives of the elective modules were clear to them in advance, the program met their academic needs, they had adequate supervision and hands-on clinical training, appropriate amount of communication skill with patient, peers and clinical staffs, how to maintain privacy while doing clinical testand it met their expectations. (Table 3).

Thematic analysis of the open-ended question to explain the reason behind choosing ECG and PFT as electives, 48.28% remarked that they wanted to learn the topic as it will help them to become a good clinician in future. 37.93% choose it due to its clinical relevance and 6.9 % replied they were interested about the topics. (Table 4).

Thematic analysis of the responses regarding positive points of the electives identified five themes e.g. clinical exposure, diagnostic skills, knowledge expansion, practical skills and overall general positivity. (Table 5)Maximum students pointed out gaining diagnostic skills (34.48%) and expansion of their knowledge (31.03%)) as the eminent admiring point of these modules.

Thematic analysis of the reactions regarding negative points of the electives identified five sub-themes. (Table 6) More exposure to clinical cases (46.43%) and shorter duration (only 15 days) (26.66%) were referred to as the adversity of this program. Table 7 demonstrates suggestions referred by the students to improve the elective module. Majority of Students' (43.33%) inference was the program was excellent and nothing to suggest. 32.14% students concluded that at least 1month

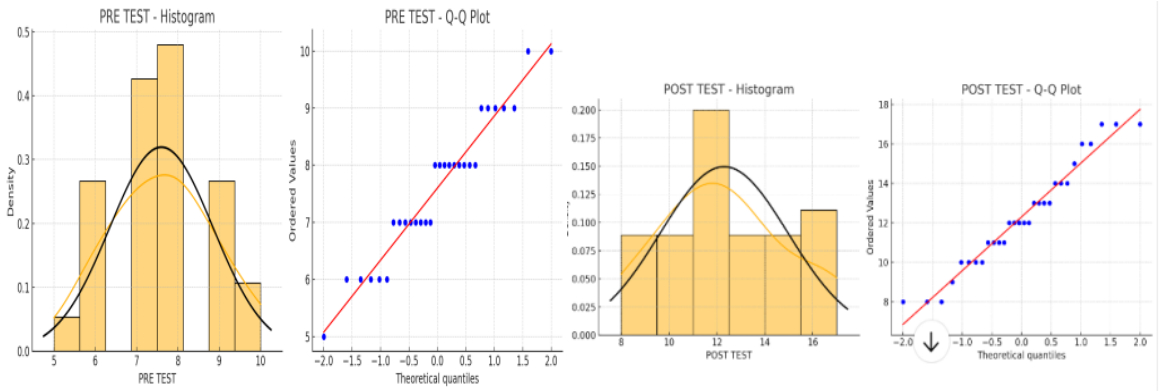
duration is needed for such modules. 17.87% suggested more case-discussion of abnormal ECG and PFT are required to have a sound grip on the subject.

The predominant response from the faculty indicates that the objectives of the elective module were predominantly achieved. A considerable number of faculty members expressed that student demonstrated receptiveness to their educational needs and proactively engaged in the elective activities, as summarized in Table 6. Furthermore, a majority of the faculty concurred that the elective served as a commendable academic endeavour, with an appropriate time duration allowing for the display of creativity, lateral thinking, and collaborative teamwork. The whole experience of the electives was predominantly rated as good, very good, or excellent by most faculty members, as outlined in Table 8. Faculty participants highlighted several advantages associated with electives, including the prospect to refresh clinical understanding, develop new clinical abilities, acquire additional knowledge, and cultivate new skills, thereby gaining enhanced exposure to patients. The supportive nature of fellow faculty members emerged as a notable strength of the program, as delineated in Table 8.

Despite the positive feedback, a notable proportion of faculty members acknowledged that the program implementation did not meet their expectations, attributing this deviation to their demanding schedules, as detailed in Table 6. Additionally, faculty members provided valuable suggestions for program improvement, as outlined in Table 8.

Table 1: Demographic pattern of students who choose ECG and PFT electives:

	ECG and PFT
Total number	**30** **Male: 14 (46.66%), Female: 16 (53.33%)**
Average age (Mean± SD)	23±1.18 years
Attendance	100%
Choice of electives in block 1	ECG and PFT was 1st choice- 26 (86.66%) 2nd choice -4 (13.33%)



Shapiro-Wilk test	**P value: .1422**
Kolmogorov- Smirnov test	**K-S test statistic (D) is .16107.**

Figure 1: Q-Q plot, The Shapiro-Wilk test and Kolmogorov- Smirnov test results indicate that both pre-test and post-test score are normally distributed (p > 0.05). Therefore, the appropriate statistical test for comparing the means between these two independent groups is the Independent Samples t-test.

Table 2a: Pre-test vs Post-test score of electives:

	Mean± SD (n=30)	**Degree of Freedom**	**95% Confidence interval difference**	**P value**
Pre test	10.003± 2.55	58	0.95 to 3.59	0.0014*
Post-test	12.31±2.67	58	0.95 to 3.59	

The t-value is -5.11113. The p-value is < .00001. The result is significant at p < .05

Table 2b: Pre-test vs Post-test score of ECG

	Mean± SD (n=30)	**Degree of Freedom**	**P value**
Pre test	9.68± 2.67	15	0.0038*
Post-test	12.5±2.89	15	

The t-value is -2.85176. The p-value is .003898. The result is significant at p < .05.

Table 2c: Pre-test vs Post-test score of PFT:

	Mean± SD (n=30)	Degree of Freedom	P value
Pre test	8.35± 1.27	15	0.000016*
Post-test	12.07±2.46	15	

The t-value is -5.00727. The p-value is .000016. The result is significant at $p < .05$

Table 3: Perception of students on ECG and PFT electives in Likert scale

Questions	Response	Count	Proportion (%)	Likert scale score
1. The objectives of the electives were clear to me in advance.	Agree	18	60	**4.07**
	Strongly Agree	6	20	
	Neutral	6	20	
2.The program was responsive to my needs (both academically and socially	Agree	17	56.66	**4.18**
	Strongly Agree	9	30	
	Disagree	4	13.33	
3. I had adequate supervision during training.	Agree	14	46.66	**4.35**
	Strongly Agree	12	40	
	Neutral	4	13.33	
4. I had adequate opportunities for hands-on clinical work	Strongly Agree	18	60	**4.57**
	Agree	8	26.66	
	Neutral	4	13.33	
5. The elective provided me an appropriate amount of communication skill with patient	Agree	18	60	**4.21**
	Strongly Agree	8	26.66	
	Neutral	4	13.33	
6. The elective provided me an active learning through discussion/ participation	Agree	20	66.67	**4.28**
	Strongly Agree	10	33.33	
7. The elective helped me to learn how to deal with a different culture and how to maintain privacy of patients while performing clinical test	Agree	1	3.33	**4.28**
	Strongly Agree	20	66.67	
	Neutral	9	30	
8. The elective helped me to learn how to communicate with patient	Agree	15	50	**4.10**
	Strongly Agree	10	33.33	
	Neutral	5	16.67	
9. The elective helped me to learn how to deal with co-workers and non-clinical staff in working environment	Strongly Agree	15	50	**4.10**
	Agree	10	33.33	
	Neutral	5	16.66	
10. The elective met my expectations	Agree	18	60	**4.07**
	Strongly Agree	8	26.67	
	Neutral	4	13.33	

Table 4: Typical Responses to the open- ended questions by Students (Why you have chosen these electives?): (Thematic analysis)

Theme	Count	Example	Proportion (%)
Knowledge Enhancement	14	I wanted to learn the topic as it will help me to be a good clinician	48.28
Clinical Relevance	11	Clinical application	37.93
Other	**5**	I was interested in the topic.	6.9

Table 5: Positive points about the electives (Thematic analysis)

Theme Positive points about these electives	Sub-themes	Number	Proportion (%)	Examples
1	Clinical Exposure	3	10.34	'Clinical application'
2	Diagnostic Skills	10	34.48	'I wanted to learn the topic as it will help me to be a good clinician', 'It is an essential skill to diagnose patients

3	General Positive	4	13.33	'To have an hand on practice how to do spirometry on the clinical scenario',
4	Knowledge Expansion	9	31.03	'I want to learn that. It is important',
5	Practical Skills	5	17.24	'I wanted to learn about the procedure and interpretation of ECG as it is of great importance in clinical practice and has many diagnostic value'

Table 6: Negative points about the electives (Thematic analysis)

Theme Negative points about these electives	Sub-theme	Number	Proportion (%)	Examples
1	Content Overload	3	10.71	Abnormalities of ECG &PFT was tough
2	General Issue	13	46.43	Needed few more seatings',
3	Insufficient Classes	3	10.71	'If more classes could have been arranged.
4	No Negative Feedback	3	10.71	'I want to learn that. It is important',
5	Short Duration	8	26.66	'The time duration of the elective should have been a bit more so as to learn more about the interpretation of the ECG', 'Only 14 days' time is very short for learning

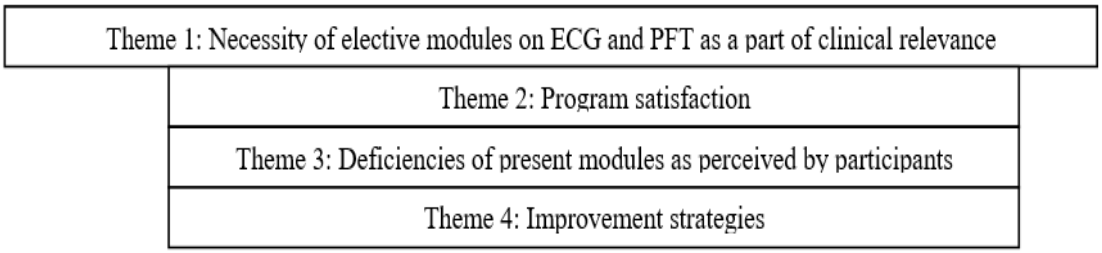
Table 7: Suggestion to improve in future (Thematic analysis)

Theme Positive points about these electives	Sub-theme	Number	Proportion (%)	Examples
1	General Suggestion	13	43.33	'Nothing to suggest. It was excellent
2	Increase Duration	9	32.14	'The duration of the elective should be at least 1 month as it is not possible to learn ECG in 15 days and it requires more practice', 'The time duration for the elective should be of 1 month at least'
3	More Classes	5	17.86	'Required more class on abnormalities of ECG and PFT'
4	No Suggestion	3	10.71	'Not such'

Table 8: Typical Responses to the open- ended questions by Teachers: (Thematic analysis)

Positive points	**n**	**%**
The strength lies in individual interactions of teacher and student since the number of students is small. Every student gets equal opportunity to clear misconceptions and understand the subject matter better Performing the procedure on own under supervision of teacher gives confidence to the student to face real life situation demanding the manoeuvre later on.		66.66
Will help students to have a taste of their area of interest. Also, will increase students' confidence	3	50
In depth study in the modules and hands on approach	1	16.66
Negative points	**n**	**%**
Duration was limited to get full confidence or control over the test	6	100
Integration with clinical faculty is lacking and this can be considered a weakness	2	33.33
Infrastructure of all medical colleges are not uniform. So, students of rural medical colleges like us are getting less exposure to super speciality departments	1	16.66

Focus group discussion with the participants: The qualitative analysis of the focus group discussion revealed four themes.1) Necessity of elective modules on ECG and PFT as a part of clinical relevance2) Program satisfaction 3) Deficiencies of present module as perceived by participants 4) Improvement strategies.



Theme1: Necessity of elective modules on ECG and PFT as a part of clinical relevance: Students believed that ECG and PFT to be included as elective modules. Student 24 pointed out "I wanted to learn the procedure as it is of great importance in clinical practice and has many diagnostic values." Student 25 felt "I wanted to learn the topic as it will help me to be a good clinician". Student 17 pointed out "I wanted to have a hands-on practice so that it will help me in clinical scenario". Student 16 depicted "I wanted to have hands-on training and ability to interpret the result as it will be helpful for me in future".

Theme 2: Program satisfaction: Student 1 stated "I had opportunities to perform the test on my own and got chance to communicate with patient". Student 8 described "It was an interactive session, and I had opportunities for hands-on clinical work". Student 4 remarked "Basic concepts were clear with clinical interpretation". Student 9 pointed out "Learned the concepts behind waves and gained knowledge". Student 6 felt "Learning cardiac abnormality curve made me more confident "Student 15 suggested "The program was excellent"

Theme 3: Deficiencies of present module as perceived by participants: Majority of the students felt the time duration of this module is inadequate. Student 2 stated "Only 14 days' time is very short to learn such clinical procedures in detail." Student 23 pointed out 'More theory classes are needed to understand abnormal ECGs. Students 20 felt 'I would like more days of hands-on experience"

Theme 4: Improvement strategy: All that a good elective module like ECG and PFT require is fostering more clinical exposure and hands-on practice. This was reflected by students' discussion.

Although 10 students stated, 'There is nothing to suggest, it was excellent', student 2 felt "The time duration for the elective should be of 1 month at least'. Student 4 suggested 'Better time management and effective distribution of topics taught every day can be done better."

Interestingly one student suggested "There should be arrangement for refreshment on the day of presentation'. Student 11 felt "There should be more classes on abnormal ECG interpretation".

Theme	Responses
Theme1: Necessity of elective modules on ECG and PFT as a part of clinical relevance:	*"I wanted to learn the procedure as it is of great importance in clinical practice and has many diagnostic values." "I wanted to have a hands-on practice so that it will help me in clinical scenario"*
Theme 2: Program satisfaction	*"I had opportunities to perform the test on my own and got chance to communicate with patient". Basic concepts were clear with clinical interpretation"*
Theme 3: Deficiencies of present module as perceived by participants	*"Only 14 days' time is very short to learn such clinical procedures in detail" 'More theory classes are needed to understand abnormal ECGs*
Theme 4: Improvement strategy	*"The time duration for the elective should be of 1 month at least'. 'There is nothing to suggest, it was excellent'. "There should be arrangement for refreshment on the day of presentation'*

Chart 2:

Discussion

There is no single technique of teaching-learning method that befitting all students. Thus, there is an extreme requirement to revamp teaching/learning experience to each student, which substantiates the essence of electives in pre-graduated

curricula.[15,16] Hence as instructed by the National Medical Commission (NMC) of India (Medical Council of India, 2020) the elective module was administered in our medical college for MBBS students of batch 2021.

All the students actively took part in the electives module. Most students said that the elective program met their expectations. They had adequate opportunities for hands-on clinical work and also had sufficient supervision during their training. Electives abetted them to secure proper communication skills with patients, to accomplish how to deal with co-workers and other staffs in working environments and how to comply as a team. Students' perception was very optimistic regarding the elective's module. This agrees with the studies done by Couper et al in 2015 and Ahsin & Saeedet al in 2016 [16,17]. Students' apprehension was very encouraging regarding the elective module. Most of the students appraised the total experience of electives as 'good' or above. Students acknowledged that it was an excellent academic activity. Also, it provided them with as cope to demonstrate their ingenuity and lateral thinking, and to function as a member of the healthcare team. They achieved a new outlook about preclinical subjects. This result is in accordance with the studies done by Van den Broek et al [17].

All 30 students stated they chose ECG or PFT as they wanted to know more about the topics. 11of them felt the need of clinical application of these procedures in future. Almost same result was obtained by Kalpesh Vidja [18] et al in their study performed in a medical college of Gujrat.

Regarding the positive notes of the program, students mentioned that electives gave them an opportunity to gain practical application of knowledge, to develop interpersonal skills, and direct exposure to patients. They felt active learning through discussion would be helpful for conditioning of final professional exam.

Regarding the implausibility of the program, most students responded that there were none. However, some said that it was not as expected due to the busy schedules of the faculty members. Harvey et al., Ramalho et al., van den Broek, Wu & Greenbergand Agarwal, reported identical findings in their studies [3,17,19,20]. Students gave some important recommendations regarding the program too. Most of them propounded increasing the duration of electives will be more effective.

During the interview almost all students acknowledged they have gained erudition on the topics and this upgraded their ability to interpret result of ECG and PFT in clinical setting. Our quantitative analysis on the pre-test and post-test score also depicted that students have gained statistically significant knowledge after the completion of the module.

The overall notion of faculty toward the elective module was primarily favorable, with a convincing proportion rating the experience as 'good' or higher. Faculty conceded the module as appreciable academic activity with the supremacy of this program lying in individual interactions of teacher and student since the number of students is small.

They agreed every student gets equal chance to clear misconceptions and understand the subject matter better. Performing the procedure on own under supervision of the teacher gives confidence to the student to face real life situation demanding the maneuver later. They also connoted that elective would help students to have a taste of their area of interest and will increase students' confidence. Teachers suggested that in depth study in the modules and hands on approach is the essence of elective.

Faculty members recognized electives as a means of expanding one's knowledge base, honing one's skill set, and getting hands-on experience with patients while discussing the program's merits. Past studies done by Neel et al [21] and Drum et al [22] reported similar findings.

While most faculties perceived no weaknesses in the program, some noted that the duration was limited to get full confidence or control over the procedure. Some of them also pointed out integration with clinical faculty are lacking and this can be considered a weakness.

Strength, Weakness, Opportunity and Challenges analysis:

Strength:

1. Mixed-method design combining quantitative (pre-post-test, Likert scale) and qualitative (FGDs, open-ended responses) furnishes robust triangulation.
2. Statistically significant enhancement in knowledge shown by t-test ($p < 0.05$).
3. 100% attendance and high engagement of students.
4. Positive perception from both students and faculty toward hands-on experience and skill development.
5. Validated tools and ethical clearance assure study quality.
6. Integration of focus group discussions augments depth of insight.

Weakness:

1. Small sample size (n=30), limits generalizability.

2. Single-institution study reduces external validity
3. Short duration (15 days) perceived as inadequate by both students and faculty.
4. Infrastructure limitations in rural medical colleges mentioned.
5. Lack of integration with clinical departments cited by faculty.

Opportunities:

1. Scalable model for implementing electives across other preclinical departments.
2. Improvement suggestions (e.g., longer duration, more clinical case discussions) can guide future modules.
3. Faculty development and interdisciplinary integration could enhance effectiveness.
4. Can inform policy changes in NMC elective implementation.

Challenges:

1. Faculty time constraints and administrative burdens (e.g., logbook signing).
2. Non-uniform infrastructure across colleges might hinder replication.
3. Possible resistance to curriculum change or elective expansion without institutional support.
4. Risk of electives being treated as formality without adequate supervision and feedback mechanisms.

Conclusion:

This study depicted a successful implementation of electives in Physiology department emphasizing the potential of pre-clinical subjects as a topic for electives. Students' positive perception impel us for its continued promotion and expansion. The faculty's insight offers constructive recommendations for improving upcoming execution of the elective module.

Limitation:

The study is done on a single medical college and with a single batch of MBBS students. Including more batches and a greater number of medical colleges will give a better view of the research hypothesis.

Translatory component actualized in the study:

1. **Educational Problem Identified**: Incorporation of ECG and PFT electives into the MBBS curriculum as hands-on, skill-based modules.
2. **Knowledge Application**: Statistically significant improvement in pre- and post-test scores (e.g., ECG: $p = 0.0038$; PFT: $p = 0.000016$). Therefore, it is illustrated that structured electives intensify students' clinical knowledge.
3. **Student-Centered Learning**: High levels of contentment and worthwhile perception from students (Likert scale > 4.0 across responses). It highlights on active learning, self-directed practice, and student-led presentations.
4. **Skill Translation**: Students delineated increased diagnostic skills, communication, privacy maintenance, and teamwork. Hence direct clinical skill-building and communication competence executed through supervised hands-on sessions.
5. **Curricular Integration**: NMC-mandated electives (2 weeks) assessed through formative and summative tools. In this study Logbook, assessments, and FGD are combined as part of customary curriculum.

References

1. Howard WG. The encyclopedia Americana. New York: Encyclopedia Americana Corp; 1918. Available from: https://archive.org/details/encyclopediaame27unkngoog/page/n98/mode/1up?q=elective+course. Accessed 2023 Apr 11.
2. Khilnani AK, Thaddanee R. Designing and implementation of electives training in competency based medical education curriculum. GAIMS J Med Sci. 2022; 2(1):1-5. Available from: https://zenodo.org/record/5832251
3. Ramalho AR, Vieira-Marques PM, Magalhães-Alves C, Severo M, Ferreira MA, Falcão-Pires I. Electives in the medical curriculum – an opportunity to achieve students' satisfaction? BMC Med Educ. 2020; 20:449. doi:10.1186/s12909-020-02269-0
4. Al-Taher R, Al-Ani R, Al-Ani A, Rashdan M, Al Manasra ARA, Aborajooh E, et al. The clinical elective course and its effects on medical students and graduates of Jordanian medical schools. BMC Med Educ. 2022; 22(1):716. doi:10.1186/s12909-022-03779-9
5. Stys D, Hopman W, Carpenter J. What is the value of global health electives during medical school? Med Teach. 2013; 35(3):209-18. doi:10.3109/0142159X.2012.731107
6. Stone SL, Moore JN, Tweed S, Poobalan AS. Preparation, relationship and reflection: lessons for international medical electives. J R Coll Physicians Edinb. 2022; 52(2):95-9. doi:10.1177/14782715221103406
7. Bath MF, Norris EJ, Fitzgerald JEF. International medical student electives: opportunity to support health worker education. Postgrad Med J. 2020; 96(1134):181-2. doi:10.1136/postgradmedj-2019-136916
8. Mahajan R. Electives in undergraduate medical training in India – a revolutionary step. J Res Med Educ Ethics. 2020; 10(1):1-2.

9. National Medical Commission. UG Curriculum. Available from: https://www.nmc.org.in/information-desk/for-colleges/ug-curriculum
10. Association of American Medical Colleges. Curriculum inventory. Available from: https://www.aamc.org/about-us/mission-areas/medical-education/curriculum-inventory
11. Mihalynuk T, Leung G, Fraser J, et al. Free choice and career choice: clerkship electives in medical education. Med Educ. 2006; 40(11):1065-71.
12. Ahsin S, Saeed GN. Medical electives: students' perspective. J Pak Med Assoc. 2016; 66(4):404-8.
13. Reed CR, Garcia LI, Slusser MM, Konowitz S, Yep J. Linking essential learning outcomes and interprofessional collaborative practice competency in health science undergraduates. J Scholarsh Teach Learn. 2017; 17(1):15-23. doi:10.14434/josotl.v17i1.19607
14. Couper I. Student perspectives on the value of rural electives. Afr J Prim Health Care Fam Med. 2015; 7(1):752. doi:10.4102/phcfm.v7i1.752
15. van den Broek WES, Wijnen-Meijer M, Ten Cate O, van Dijk M. Medical students' preparation for the transition to postgraduate training through final year elective rotations. GMS J Med Educ. 2017; 34(5):Doc65. doi:10.3205/zma001142
16. Vidja K, Patel J, Patidar H, Akhani P, Patel P. A study on perception of medical students regarding implementation of elective module in India. Res Dev Educ (RaDEn). 2023; 3(2):137-45.
17. Wu DJ, Greenberg PB. A self-directed preclinical course in ophthalmic surgery. J Surg Educ. 2016; 73(3):370-4. doi:10.1016/j.jsurg.2015.11.005
18. Agarwal A, Wong S, Sarfaty S, Devaiah A, Hirsch AE. Elective courses for medical students during the preclinical curriculum: a systematic review and evaluation. Med Educ Online. 2015; 20:26615. doi:10.3402/meo.v20.26615
19. Neel AF, AlAhmari LS, Alanazi RA, Sattar K, Ahmad T, Feeley E, et al. Medical students' perception of international health electives in the undergraduate medical curriculum at the College of Medicine, King Saud University. Adv Med Educ Pract. 2018; 9:811-7. doi:10.2147/AMEP.S173023
20. Drum BM, Sheffield CR, Mulcaire-Jones J, Gradick C. Formation and evaluation of an academic elective for residents in a combined internal medicine-pediatrics residency program. Cureus. 2021; 13(7):e16287.
21. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. Nurse Educ Today. 2004; 24(2):105-12.
22. McCagh J, Fisk JE, Baker GA. Epilepsy, psychosocial and cognitive functioning. Epilepsy Res. 2009; 86:1-14.