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Original Research Article

Evaluating the Impact of Basic Science Elective Modules: Medical Students' Perspective

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ABSTRACT

Introduction: Elective courses are important in undergraduate medical education worldwide. Nevertheless, there hasn't been enough research done on the role that optional courses play, especially regarding the vertical integration of basic science courses like physiology with clinical courses. Thus, more investigation is required to assess the significance and advantages of elective courses in the physiology basic science department.

The study aims to assess the perception of students for the conduct of integrative elective modules within the Department of Physiology.

Methods: Final-year medical students participated in a 60-hour, ten-day module focused on respiratory rehabilitation. The module included interactive lectures, case-based discussions, and clinical discussions on patients with skills related to Lung anatomy, Chest X-rays, pulmonary function tests, flow volume loops, arterial blood gas analysis, and yogic breathing techniques. The feedback was provided for assessment and taken for the module.

Results: The final grades for the pupils varied from 74% to 90%. Interest and motivation for elective, Perceived Clinical, teaching, patient care benefits, enhanced learning, teamwork, collaboration, revisiting curriculum, and teaching were the themes identified in the thematic analysis of the student's perceptions of the elective module.

Conclusion: The study revealed improved clinical interpretation for chest X-rays, pulmonary function tests, and critical care, as well as a rise in pre-clinical and clinical departments' interest in working together to address respiratory system topics. Though it will be too soon to determine the optional program's end conclusion, it is still a smart idea to move forward with.

KEYWORDS: Medical Education, Undergraduate Students, Elective Courses, Vertical Integration, Physiology Education.

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INTRODUCTION

The field of medical education is dynamic and ever-changing, catering to the demands of the healthcare business as well as the aspirations of future doctors. It is crucial to produce physicians who are knowledgeable, adept, and focused on the needs of their patients since India's healthcare system is under tremendous strain due to the country's growing population. It becomes essential to investigate cutting-edge teaching techniques that close the gap between fundamental science and clinical application as we work to produce medical graduates who can apply their understanding of the fundamentals of physiology to clinical practice.

Basic science courses like Physiology and Anatomy, frequently regarded as the cornerstone of medical education, provide the framework for developing clinical competence. It provides medical students with knowledge about how the body normally functions and establishes the foundation for disease diagnosis and treatment. However, there has been a growing critical examination of the conventional approach of teaching physiology mainly as a stand-alone discipline, divorced from clinical settings.

In 2019, the National Medical Commission (NMC) in India introduced mandatory electives to its medical undergraduate training curriculum, under the Competence-Based Medical Education (CBME) curriculum providing diversified learning opportunities after the completion of Final Professional Part I training [1].

The NMC proposed a supervised, self-directed elective program with 200 hours for two four-week blocks, allowing students to choose from institute-offered programs rather than a free-choice approach [2,3]. The description of those two blocks of electives is well-drafted in a study by Mathur M [4].

Beyond the regular curriculum, elective courses provide students with chances for specialized instruction in areas of current or future interest [5]. This research also explores the potential benefits, challenges, and transformative impact (**Figure 1**) of an elective course linking physiology as a basic science to its clinical application in medical education for India's future physicians [5].

The research paper explores an educational innovation in India that links basic science to clinical science, introducing an elective course for final-year medical students, aiming to create graduates with a holistic understanding of medical science and clinical acumen.

This paper explores the development, implementation, and impact of an elective course, examining objectives, curriculum design, teaching methodologies, assessment strategies, student reactions, and course effectiveness.

This research highlights the importance of basic science knowledge in clinical practice for medical students, enhancing their ability to diagnose, treat, and manage patients.

Western electives offer benefits like orientation and interest boost. At the same time, developing countries pursue electives for diverse healthcare settings, cultures, demographics, disease treatment, and unique experiences not found through books or home practice [4,6].

The objective of the study was to assess the perception of students regarding the conduct of elective courses from the Department of Physiology.

METHODS

This is a retrospective observational study for the elective course module conducted at Pramukhswami Medical College, Bhaikaka University, as per NMC guidelines. The ethical approval for this study was conducted before drafting this manuscript (IEC/BU/2023/Ex.49/241/2023; Dated: 01/09/2023).

The medical students of Batch 2019 (150 students) were divided into two groups (Block-1 & Block-2). Each student had to undertake one elective module from each block as per their choice filling and rank in the third year of the medical program. Block-1, as per NMC, was pre-selected from the preclinical, para-clinical, or other basic sciences laboratory, or under a researcher in an ongoing research project while Block-2 was supposed to be done in a

clinical department (including specialties, super specialties, ICUs, blood banks, and casualty). The institute provided 10 elective modules for Block 1 and 25 electives from Block 2. Every student had to choose one elective from each group.

Our elective module "Pulmonary Function Test (PFT) beyond Physiology" was part of Block 1. The elective was conducted twice with 10 students per group (Groups A and B). The module was jointly conducted by three departments [Physiology (primary), Respiratory Medicine, and Critical Care and Trauma] with 3 sessions from the Anatomy faculty. Total of 60 hours with interactive lecturing/case-based discussion/ clinical discussion related to admitted patients for 12 hours and rest for psychomotor skill learning related to chest X-ray, pulmonary function tests, flow volume loops, arterial blood gas (ABG) analysis, and yogic and other breathing techniques to ensure respiratory rehabilitation.

The learning outcome of the Elective module for the final-year medical undergraduate students was able to:

· identify various pulmonary parameters and their implications in health and disease.

· record, analyze, and interpret the result of various Pulmonary Function Tests and flow volume loops using a digital Spirometer instrument, and arterial blood gas analysis.

· demonstrate various exercises and yogic breathing techniques to ensure respiratory rehabilitation

The objectives for each department were finally laid out after the conduct of two to three meetings. **(Figure 1)**

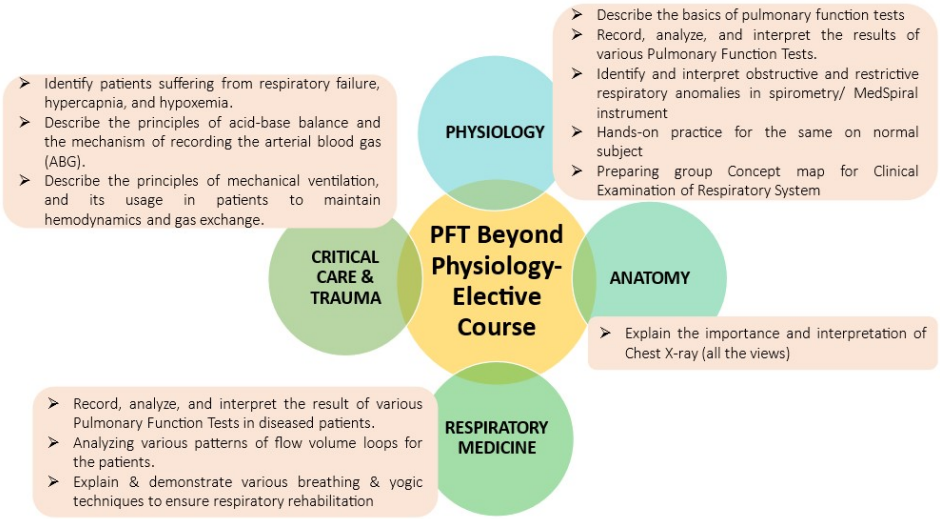

Fig. 1: Objectives for each department for the Elective course module. (Author-created image).

Attainment of transformative learning by the Elective module is well portrayed in a flowchart format by the authors in **Figure 2**.

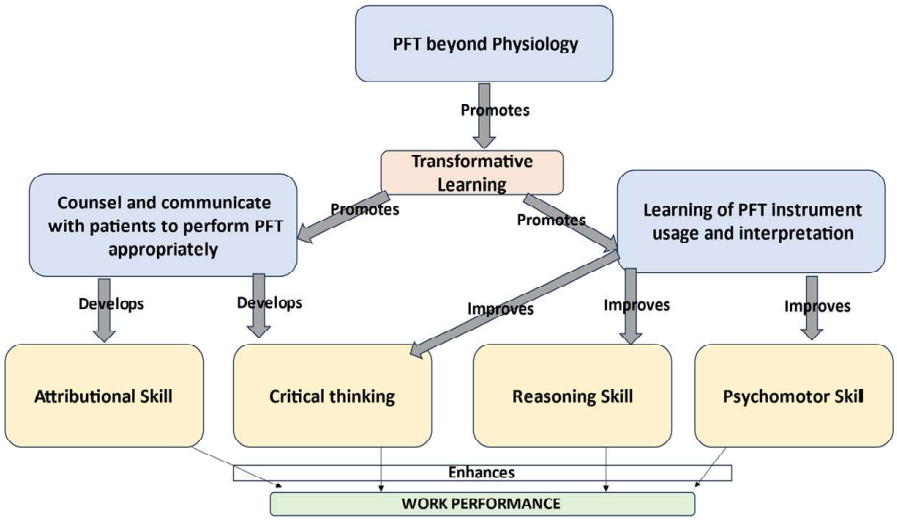

Fig. 2: Transformative Learning by Electives (Author-created image)

The assessment for the elective was predominantly formative including participation in outpatient rounds, case discussions, way of handling the instruments for the PFT and conducting tests on the patient observed by the faculty, and finally interpretation of the results attained for the PFT, other than a construct of the mind and/or concept map for the respiratory disease/disorder. The participants were asked to complete their logbook for the elective and time was provided to them for writing the reflection for the elective module and getting it signed by the course coordinator. However, the written reflection was not graded.

The elective module was conducted for 10 days, 6 hours per day. At the end of the module summative assessments (Theory and Practical) were conducted to grade their learning outcome by the faculty members of the basic science as well as clinical science. The participants of each elective group were asked to prepare a concept map for different respiratory diseases focusing on the history, clinical examination, and Pulmonary Function Test outcome. Feedback for further improvement in the concept map was provided however, those maps were not graded further.

The participants and faculty filled out the perception feedback form to have an idea about the conduct of the module and the scope of its modification.

The statistical analysis was done using SPSS-15 for percentage, mean, and correlational analysis. The thematic analysis was used to analyze the perceptional responses of the participants for the module [7].

RESULTS

The academic scores of the two groups showed results ranging from 76% to 86% (Group A), and 74% to 90% (Group B).

Table 1 showed no statistically significant correlation in the academic scores for the students of the two elective groups. The independent t-test showed no statistical significance between the groups (Sig. two-tailed: 0.668).

The first group's participants felt that more sessions should be held in the Critical Care and Trauma department rather than Respiratory Medicine because there, they were exposed to more indoor patients thus, would be able to practice more for obtaining histories and managing other critical care situations. As a result, following consultation and agreement with the relevant departments, the critical care and trauma departments received three respiratory medicine hours in the second group of the elective module.

After completion of the elective module feedback was filled by the students having five open-ended questions. The themes were derived from each of the perception questionnaires of students from both groups using a thematic analysis approach. **(Table 2).**

DISCUSSION

The elective provided to the students from the Department of Physiology was conducted for the final-year medical students as per the CBME of the NMC which included the components of providing transformative learning potential to the students as per the various studies [1-5,8].

Table 1 represents the correlational academic scores for the two groups (A & B) for the elective module while Table 2 shows the student's perception of the elective module via the open-ended questionnaire.

The present study **(Table 2)** aligns with the research conducted by Moncaliano et al. [9] which showed how beneficial the Virtual Cancer Care Elective is, as evidenced by the higher student comprehension of oncology in practice and the maximum grading of 80% for patients who share their cancer journeys. The approach improved participants' comprehension of patient-physician collaboration [9].

The present study demonstrated the increased interest of medical student participants towards the collaborative approach of pre-clinical and clinical departments for the topic of the respiratory system. An opportunity provided to students to learn concept/mind maps for the assigned topics as a group activity improved their team-building

Table 1: Correlation of the academic score for the two groups for the elective module.

		Mean	N	Std. Deviation	Std. Error Mean
Elective score: Group-B		81.693	10	5.23493	1.65543
Elective score: Group-A		80.67	10	3.49236	1.10438
Paired Samples Correlations			**Correlation**		**Sig.**
Pair 1	**Elective score: group B (N=10) & Elective score: group A (N=10)**		-0.375		0.286

A lower level of correlation was found among the academic scores for the students from elective groups A and B with no statistical significance.

Table 2: Thematic analysis of student's perspective regarding the Integrative Elective module.

S.No	Question	Themes	Sub-themes
1	Why did you choose this elective?	Interest and Motivation for the Elective Module	• The module seemed interesting
			• Fetch more grades
		Enhanced Learning and Understanding of Respiratory Physiology	• Had learned respiratory physiology well
		Perceived Clinical Benefits	• Would provide more clinical insight
			• Integrated with clinical branches
		Challenges in Undergraduate Curriculum	• Less focused during undergraduate curriculum
			• Rising cases of pulmonary diseases
2	Was the Elective delivered as per your expectations?	Clinical Skill Acquisition	• PFT (Pulmonary Function Tests)
			• ABG (Arterial Blood Gas) analysis
			• Interpretation of Chest X-ray
			• Operating Mechanical Ventilator
			• Echocardiography
			• Visualization of Lungs
		Patient-Centered Learning	• Patient Dealing
			• Care in ICU Setting
		Effective Teaching Approaches	• Mind Maps and Concept Maps
			• Interactive Learning
			• Teachers' Interest and Engagement
		Well-structured and Integrated Curriculum	• Well-Planned and Integrated
3	What did you learn from this elective activity in terms of knowledge, skills and attitude?	Knowledge Enhancement:	• Concept related to the respiratory system
			• Quick revision of Physiology
		Clinical Skills and Competencies	• Clinical case discussion
			• Clinical examination of Respiratory system
			• PFT, ABG analysis, Chest X-ray interpretation
		Learning Techniques and Strategies	• Learning technique/strategy (Concept/Mind map)
		Patient-Centered Skills and Attitudes	• Patient dealing in Critical care setting
			• Being humble
			• Developing patience with team members and patients
		Teamwork and Collaboration	• Team building
			• Group activity—cooperation
4	Do you think the time provided was adequate for the completion of the module? Explain	All the participants specified Yes for it except for one student suggesting that more time was required to understand the analysis of PFT and ABG	
5	Suggestions for modification/ improvement in the near future.	Revised Curriculum and Teaching Methods	• Theory should be less
			• More Respiratory Case-discussion and History taking
			• Explaining treatment details
		Expanding Clinical Skills and Knowledge	• Teaching other techniques like sputum collection and analysis
			• Teaching intramuscular injection and intravenous injection
			• Interpretation of X-rays
		Enhanced Integration with Clinical Departments	• Critical care department
			• Re-visit to those departments after completion of Electives

approach and cooperation within the group. The newer approach of teaching-learning approaches (case-based learning, discussion on indoor patients within the group) were well appreciated by the participants thus they specified that "we would recommend this elective to other students" These findings also supported the impression held by students in the Dai et al. study [10], which indicated that the elective course was well-liked by them and useful for improving their understanding of the material, building on what they had learned in class, and holding productive discussion sessions [10].

The students in our study mentioned enhancing their clinical and attributional skills which they normally do not learn during their medical curriculum which is aligned with the study by Svoboda et al. [11] for learning research skills via an elective module during their first year of the program [11].

The feedback from the participants showed agreement towards the benefits of the elective module as shown by Shrivastava and Shrivastava [12].

Pre-clinical electives in medical education develop critical thinking, analysis, reasoning, knowledge mastery, adaptability, teamwork, interpersonal communication, language proficiency, societal responsibility, information technology integration, information collection, analysis, and ethical adherence to norms and principles, fostering a comprehensive understanding of subject matter and professional activities [13].

According to the results of the student evaluations in a study by Bruno and Imperato [14] the medical school year elective module had the highest experience rating. Despite being optional, it lasted six to eight weeks and had academic, service, and cultural goals [14].

The medical interns, in a study by Deepak et al., [15] recognize that a firm basis for clinical practice is provided by a thorough comprehension of the basic sciences). Such input helps us identify areas for development and gives us a greater chance to prepare them to become more skilled physicians [15].

Ninety-five percent of students felt, according to a study by Ahmad et al., [16] that Clinical Skills Learning (CSL) was a helpful pre-clinical module to help third-year medical students get ready for their clinical years [16].

According to Tayade et al., [17] study, which considered data from six medical colleges, early clinical exposure (ECE) is the most crucial teaching technique in the current Indian medical education system for enhancing professional skills and attitudes [17].

Researchers [17-19] have argued that early clinical exposure (ECE)—which blends basic and clinical science and promotes the development of self-directed learning skills—is linked to knowledge retention. encourages students to participate in the course and strengthens the foundational science's applicability in the clinical setting. However, according to the researchers, final-year medical students' electives help them review basic science and hone their critical thinking and problem-solving abilities [12-14].

Further Improvement

The introduction of reflective writing for the elective course (before, during, and after) will be an additional assessment tool and provide better learning to the students as well as the course coordinator for further advancement and improvement [20].

To have a better outcome for the elective course there is a need for doing focus group discussion (FGD) among the faculty members and validate the submitted module by the faculties as done by Sidhu and Mahajan [21] within their institute. There is a need to evaluate the program on feedback from the students and faculty who completed the first round of elective modules and incorporate the suggestions for redrafting the elective module.

Limitations

The coordinator didn't have a direct observation of the course implementation in other departments and was dependent on the inputs from the students.

CONCLUSION

The importance of elective courses in medical education necessitates regular evaluations of

their goals and quality to ensure they are fulfilling the needs of the students. Preclinical electives that are matched with clinical needs give medical students a learning objective for the long-term application of acquired skills.

With the help of this module, we were able to investigate possible avenues for the merging of basic and clinical science. The study also assisted the authors in forecasting extracurricular physiology course topics that will be taught to students in the future. This study identifies opportunities to improve the current program and provides the framework for related electives in the future. Furthermore, our findings might reflect our students' underlying excitement for both clinical and fundamental approaches to the study of pulmonary function disorders. Although the current study is too preliminary to suggest any positive or negative repercussions for the module, student suggestions for improvement can help achieve a better study outcome.

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Author Contributions

PD: Coordinator for the elective module; initiated the module draft; contributed to the plan, protocol writing, implementation, data collection, interpretation of data, conclusion, and final editing of the manuscript.

MP: Contributed to the plan of the elective module and manuscript, implementation, data collection, and conclusion and final editing of the manuscript.

NV: Contributed to the planning, protocol writing, implementation, interpretation of data, and writing the discussion and conclusion, final editing of the manuscript.

AP: Contributed to implementation, data collection, interpretation of data, and final editing.

SC: Contributed to the plan of the elective module, implementation of the method, data collection, and final editing.

NVK: Contributed to the plan of the elective module, implementation of the method, data collection, and final editing.

Conflicts of Interests: **None**

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