

Students' Perspective Regarding Current Pathology Training in Theory Classes in MBBS Course and Insights to Improve Teaching–Learning Strategies: A Study in Central India

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Abstract

Background: As the subject pathology in second MBBS represents a transition phase between theoretical knowledge regarding etiopathogenesis of a disease and communication with patients in clinics, the main goal of a medical teacher is to provide a framework for the description of disease course and to understand the clinical signs/symptoms for management aspects as well. **Objectives:** The aim of this article is to find out students' perception of importance of pathology subject in MBBS curriculum as well as to assess subject understanding, teaching methodology, and assessment criteria. **Settings and Design:** This is a cross-sectional descriptive e-platform-based feedback analysis. **Materials and Methods:** Ninety-eight students of 2nd MBBS (2018 batch) who were about to appear in university examination in the year 2020 were enrolled. The feedback from students was obtained. **Results:** About 75.8% of students were satisfied with number of lectures for the chapters taught during their tenure. About 91% ($n = 81$) opined that combination of two or more methods is better while teaching for better understanding; 73.6% ($n = 67$) felt that pathology lectures were interactive enough. About 80.2% ($n = 73$) opined that adequate diagrams, flow charts, tables, and clinical applications were included in the lectures, and 79.1% ($n = 72$) of the students opined that they could implement the knowledge gained in first year whereas 82.5% was same regarding implementation in clinical posting. About 71.34% ($n = 65$) suggested that weightage of internal examination marks should be increased and 50% passing cut off in university examination should be reduced. **Conclusion:** The study has emphasized the importance of pathology as a subject for understanding clinical subjects and underlines the need of a few changes in teaching-learning process and assessment criteria as per student's perception. As NMC has implemented its competency-based curriculum from 2019 batch onwards, it requires a fundamental change of the roles and commitments of not only educators but also planners and policymakers.

Keywords: Pathology training, perception, second year MBBS, students' feedback, theory classes

INTRODUCTION

A sound knowledge of pathology subject plays an important role in developing scientific clinical acumen.^[1] In the outgoing traditional curriculum by Medical Council of India (MCI), the second MBBS is a transition phase when a student is taught regarding etiology and pathogenesis of a specific disease, and communication with a patient in clinical posting is initiated as well.^[2,3] It is a first step for the student toward the meaningful clinical experience in MBBS. The subject pathology forms a bridge between the basic sciences and clinical medicine, and thus

understanding of the pathological process in detail is of vital importance.^[3]

The main objective of teaching in pathology subject is to make the student understand the exact structural and

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functional changes in the disease, which leads to specific signs, symptoms, and the disease course.^[3] If proper core knowledge is provided at this stage, a student will be able to interpret and analyze the clinical scenarios.^[4] A fine meticulous planning is needed to decide regarding strategy to teach this vast subject to students.^[3,4]

Students' feedback on delivery of curriculum plays an important role to improve the existing teaching-learning and assessment methods.^[5] Based on the feedback, the undergraduate medical curriculum has evolved into new Competency-based Medical Education (CBME) model by National Medical Commission (NMC) from discipline-based to integrated core- and option-based, from being teacher-centered to student-centered, and from passive acquisition of knowledge imparted by teachers to active problem-based learning by students.^[2,6] This underlines the significance of students' perceptions and feedback in program evaluation as it is easily available, inexpensive, and reliable if done with planning at regular intervals and if upgraded teaching strategies are implemented with necessary modifications after feasibility analysis.^[7]

Examination results are another way to know how successful the teaching is. However, examination results are dependent on many other factors also. Further, examinations if focussing on learning only cannot assess understanding of the subject. And so, it is essential to know students' perception.^[6,7] The present study was aimed to evaluate students' perspective regarding current pathology training in theory classes in second MBBS professional phase at medical teaching institutes in Central India.

Aims and objectives

1. To get insights into students' perspectives regarding:
 - a. Importance of pathology as a subject.
 - b. Combination of best teaching methodology tools that can improve students' understanding and engagement.
 - c. Current assessment methods.
2. To analyze students' feedback and suggestions for the betterment of teaching and assessment strategies in future.

MATERIALS AND METHODS

It was a cross-sectional, descriptive e-platform-based study which was conducted at Mahatma Gandhi Institute of Medical Sciences (MGIMS), Sevagram, Wardha, Maharashtra, a rural tertiary-care teaching institute in Central India over a period of 4 months from December 2020 to March 2021.

Case selection criteria

This includes all the second professional MBBS students ($n = 98$) of 2018 batch.

Exclusion criteria

Seven students who did not participate in filling the feedback questionnaire were automatically excluded from the study, leaving a sample size of 91.

Feedback collection

The duration of second MBBS was roughly one and half years in the conventional curriculum. The last batch (UG-2018) joined Pathology in August 2019, and its tenure was over in September 2020. University examinations are still not over due to COVID-19 pandemic.

After approval from the Institutional Ethics Committee, an extensive questionnaire proforma was prepared comprising questions related to the pathology subject understanding, teaching methodologies used in the institute, content and quality of the lectures taught, and assessment criteria to gather the maximum possible required information. Students' identity was kept anonymous as personal details of the students such as email ID, name, or contact number were not required to fill up the form. After prevalidation and pilot testing, the online survey questionnaire was mailed to the participant students in the month of December 2021, and the students were asked to respond to all statements based on their own judgment. No formal consent was required as the filling up of the questionnaire was voluntary and participation was considered as an adequate and implied consent. Out of the 98 eligible students, 7 students did not respond to the survey. So finally, evaluation of 91 feedback forms was done.

Ethical issues

The prior approval was taken from the Institutional Ethics Committee vide letter number MGIMS/IEC/PATH/107/2020, dated December 14, 2020. All the responses were kept anonymous and used only for research purpose.

Statistical analysis

Data were recorded using Microsoft Excel and analyzed using IBM Corp., Released 2011 (IBM Statistics for Windows, Version 20.0, Armonk, NY, USA). Categorical variables were expressed in terms of number and percentage.

RESULTS

Demography of study population (untabulated data): Out of the 91 students, 57 (62.6%) were males and 34 (37.4%) were females. The age of students ranged from 20 to 25 years with 20 years ($n = 37$, 40.7%) being the commonest age, followed by 21 ($n = 30$, 33%), 22 ($n = 13$, 14.3%), and 23–25 years ($n = 11$, 11.9%).

Majority of the students ($n = 69$, 75.8%) were satisfied with the number of lectures for the chapters taught during

their pathology tenure. About 82.4% ($n = 75$) felt that one chapter should be completed before starting of next topic as it becomes difficult for students to study two to three topics at the same time, whereas 11% ($n = 10$) were comfortable for the existing pattern of taking two chapters at a time and 6.6% ($n = 6$) were not sure for the same. Majority of the students ($n = 81$, 91%) opined that combination of two or more methods should be used while teaching. The individual preferences are given for case-based demonstrations ($n = 53$, 58.2%), chalk and board ($n = 25$, 27.5%), power point presentation, as well as question and answer method ($n = 5$, 5.5%) and group discussion studies ($n = 3$, 3.3%) [Table 1].

Regarding quality of teaching in the subject pathology, 73.6% ($n = 67$) felt that pathology lectures were interactive enough, whereas 26.4% ($n = 24$) wanted more interaction; 74.7% ($n = 68$) opined that delivery and pace of delivering lectures were suitable for their understanding. About 93.4% ($n = 85$) agreed that they were encouraged to ask questions during the classes and further 81.3% ($n = 74$) felt that lectures/demonstrations were taught in such a way to stimulate their interest in the subject. When asked regarding the content of the classes during teaching, 65.9% ($n = 60$) responded that topic was thoroughly covered, and 85.7% ($n = 78$) students opined that proper explanations and examples were provided to clarify their doubts in the subject. About 80.2% ($n = 73$) opined that adequate diagrams, flow charts, tables, and clinical insights were included in the lectures wherever needed [Table 2].

About 78% ($n = 71$) of the students found pathology as an interesting subject, whereas 3.3% ($n = 3$) found it as a boring subject and 18.7% ($n = 17$) responded it to be neutral. Similarly, more than half of the students [54.9% ($n = 50$)] found it as a lengthy subject to study, 26.4% ($n = 24$) found as difficult to study, and only 18.7% ($n = 17$) felt it as easy to study. Out of all, 56%

($n = 51$) found systemic pathology more interesting than general pathology [44% ($n = 40$)]. About 79.1% ($n = 72$) of the students opined that they could implement the knowledge gained in first year, especially in histology, in understanding pathology in the second year, and 82.5% ($n = 76$) of the students opined that they could implement the knowledge gained in pathology in clinical postings. Similarly, 87.9% ($n = 80$) of the students could implement the knowledge gained in general pathology while studying disease in systemic pathology, and 53.1% opined that they may choose pathology as their career in future [Table 3].

When asked regarding assessment mode and criteria for passing in the subjects in university examination, almost two-thirds of the students ($n = 69$, 75.8%) were comfortable with 50% as a requirement for passing while 24.2% ($n = 22$) were not. About 68.1% ($n = 62$) of the students wanted to still lower down this cut-off criterion. Half of the students ($n = 48$, 52.7%) opined that weightage of internal assessment marks should be increased, whereas rest ($n = 43$, 47.3%) were in favor to decrease the same; 74.7% ($n = 68$) opined that assessment done in the form of written examination was able to evaluate the command on the subject. Majority of the students (93.4%, $n = 85$) found that discussion

Table 2: Students' perception regarding quality and content of teaching

Sr. no.	Quality of teaching	
1	Lectures were mostly	
	Sufficiently interactive	67 (73.6%)
	Need more interaction	24 (26.4%)
2	Was delivery and pace of delivering lectures suitable to the level of your understanding?	
	Yes	68 (74.7%)
	No	23 (25.3%)
3	Were students encouraged to ask questions?	
	Yes	85 (93.4%)
	No	6 (6.6%)
4	Were lectures/demonstrations taken in a way that stimulated your interest in the topic/subject?	
	Yes	74 (81.3%)
	No	17 (18.7%)
Content of the classes during teaching		
5	Was the topic thoroughly covered?	
	Yes	60 (65.9)
	No	31 (34.1%)
6	Were proper and satisfactory explanations given to clarify the doubts/questions/pathogenesis?	
	Yes	78 (85.7%)
	No	13 (14.3%)
7	Were diagrams, graphs, flow charts, tables, and clinical applications included wheresoever required?	
	Yes	73 (80.2%)
	No	18 (19.5%)

Table 1: Students' perception regarding broader aspects of pathology theory teaching

1	Were number of lectures for most topics/chapters was adequate?	
	Yes	69 (75.8%)
	No	22 (24.2%)
2	Do you think one topic in pathology must be completed before starting next as it is difficult to study 2-3 topics/chapters at a time?	
	Yes	75 (82.4%)
	No	10 (11%)
	May be	6 (6.6%)
3	Which teaching or learning tools do you like the most?	
	Case-based demonstrations	53 (58.2%)
	Chalk and board	25 (27.5%)
	Power point presentation	5 (5.5%)
	Question and answer	5 (5.5%)
	Group discussions	3 (3.3%)
	Combination of two or more methods	81 (91%)

Table 3: Students' perception regarding subject understanding

Sr. no.	Question	Answer
1	The subject Pathology is	
	Interesting	71 (78%)
	Boring	3 (3.3%)
2	How do you feel regarding studying of subject Pathology?	
	Easy	17 (18.7%)
	Difficult	24 (26.4%)
3	Which is more easy and interesting (General/Systemic) Pathology?	
	General	40 (44%)
	Systemic	51 (56%)
4	Are you able to implement the knowledge gained in first year (especially histology) in pathology?	
	Yes	72 (79.1%)
	No	19 (20.9%)
5	Are you able to implement the knowledge gained in pathology understanding of clinical subjects and basis of patient management?	
	Yes	76 (82.5%)
	No	15 (16.5%)
6	Are you able to implement the general pathology knowledge while studying diseases in systemic pathology?	
	Yes	80 (87.9%)
	No	11 (12.1%)
7	Will you choose Pathology for your postgraduate studies, in future?	
	Yes	16 (17.5%)
	No	43 (47.8%)
	May be	32 (35.6%)

Table 4: Students' perception regarding assessment mode and criteria

Sr. no.	Assessment mode and criteria	Answers
1	Is 50% passing is adequate for passing?	
	Yes	69 (75.8)
	No	22 (24.2%)
2	Passing cut-off in university examination should be	
	Increased	29 (31.9%)
	Decreased	62 (68.1%)
3	Weightage of internal assessment marks should be	
	Increased	48 (52.7%)
	Decreased	43 (47.3%)
4	Was assessment conducted in the form of written examination able to evaluate your command on the subject?	
	Yes	68 (74.7%)
	No	23 (25.3%)
5	Discussion done over theory question paper after examination was	
	Helpful	85 (93.4%)
	Not helpful	6 (6.6%)
6	Number of internal examinations (3 before university exam) should be	
	Increased	65 (71.34%)
	Decreased	26 (28.6%)

done over theory paper after each examination was helpful; 71.34% ($n = 65$) of the students suggested that number of internal assessment examinations should be increased, whereas 28.6% ($n = 26$) were in favor to decrease the number [Table 4].

When asked for suggestions to improve delivery of overall second year curriculum in the pathology subject, 76.9% ($n = 70$) requested to increase the number of theory lectures. Majority of the students ($n = 66$, 72.5%) suggested to increase vertical as well as horizontal integration as a mode of teaching, 14.3% ($n = 13$) for only vertical integration, and 13.2% ($n = 12$) were in favor of only horizontal one. About 86.8% ($n = 79$) responded that group discussions should be increased during theory classes for the specific topics. Majority of the students ($n = 89$, 97.8%) were in favor to increase the case-based learning during theory classes [Table 5].

DISCUSSION

While our students expressed their satisfaction with the teaching of pathology using interactive lectures encouraging them to ask questions during and after the theory classes, case-based discussions, use of multiple teaching-learning tools, integration with other subjects to a little extent, and post-examination discussion of examination questions to improve their writing and presentation skills, there are certain areas that emerged from this feedback on which we should work in future, especially with upcoming CBME curriculum, to improve the pathology teaching even further.

Till date, many authors have presented their insights on effective feedback with multiple definitions developed in the literature.^[8] The definition of feedback in the Merriam-Webster dictionary is "the return to the input of a part of the output of a machine, system, or process" or "the transmission of evaluative or corrective information about an action, event, or process to the original or controlling source."^[8] Feedback in health professional training has

Table 5: Students' overall suggestions regarding second year curriculum

1	Number of theory lectures	
	Increased	70 (76.9%)
	Decreased	21 (23.1%)
2	Which integrated teaching mode should be increased?	
	Horizontal	12 (13.2%)
	Vertical	13 (14.3%)
3	Should group discussions be increased during theory classes of specific topics?	
	Both	66 (72.5%)
	Yes	79 (86.8%)
4	Should case-based learning be increased during theory classes?	
	No	12 (13.2%)
	Yes	89 (97.8%)
5	Should case-based learning be increased during theory classes?	
	Yes	89 (97.8%)
	No	2 (2.2%)

obtained special importance and attention due to its potential as stimulant of excellence in education.^[9] An effective pathology training is not only a basis of scientific and evidence-based clinical practice, but also of rational use of laboratories and drugs. Also, if teachers are good, students will be more stimulated to become pathologists themselves. Uninterested faculty may lead to a slow and possibly irreversible decline in pathology as a medical profession.^[2,10]

We found in our study that majority of the students (75.8%) were satisfied with the number of lectures or chapters taught during curriculum; 82.4% found that one topic in pathology should be completed before starting of next topic [Table 1]. The reason could be attributed to difficulty in studying many subjects at the same time, that too different topics of each subject. Regarding teaching tools, we found that majority of the students (91%) are in favor of combination of two or more tools to be used while teaching in order to understand the pathological processes well. If a single teaching method is used, there is limited active participation by only few front bench students. Many of the students find it boring and one-sided, and the pace of delivery, understanding of students, number of lectures, and level of difficulty for each topic are some of the many variables behind these monotonous lectures. The literature shows many studies which encouraged new innovative methods such as case discussions, group discussions, demonstrations, problem-based learning, and role play over didactic lectures.^[11-14]

Majority of the students in our study found that the lectures were interactive and the students were allowed to ask questions in the classes. The lectures were also taught in a way so that students develop interest in the topic and proper explanations were also provided to the students for their doubts [Table 2]. Most of the students were gratified with the quality and content of the lectures, the number of lectures, and important points and explanations given by the faculty to the students in clarifying their doubts. Our findings are consistent with the study conducted by Quadri *et al.*^[15] Instead of traditional one-sided lectures, if proper explanations in the form of flow charts, tables, and clinical applications are provided, it will help in better understanding of the topic.

In our study, 78% of the students found pathology as an interesting subject; though 54.9% found it as a lengthy subject to study and 26.4% ($n = 24$) found as difficult to study [Table 3]. Different studies showed different results. About 68.5% of the students were interested in pathology subject in a study conducted by Vijayan and Ponniah,^[10] whereas Goyal *et al.*^[14] found that among all subjects of second year MBBS curriculum, 43% of the students were interested in pathology and 36% of the students found it as difficult. Although more than half of the students found systemic pathology more interesting than general

pathology, 88% of the students responded that they could implement general pathology knowledge in systemic pathology. In our study, 79.1% of the students opined that they were able to implement the knowledge gained in first year, especially in histology, in understanding pathology in the second year; this can further be increased by discussing normal histology just before teaching systemic pathology during theory classes. It will help in better understanding, assurance, and better performance of the students in examination. Al Khader *et al.*^[7] in their study on 214 students found that 87% of the students were in favor of teaching pathology and histology in single year together rather than two different years in MBBS. Moxham *et al.*^[16] also favored the integrated teaching of pathology and histology in their study in Europe.

Assessment is one of the most important factors of students' learning because it is an established fact that the type of assessment methods heavily influences patterns of students' learning.^[10,17]

At present, there are only 30 out of 150 marks allotted for internal assessment taken in the form of three term end examinations. In our study, 52% of the students opined that the weightage of internal assessment marks should be increased; 71% of the students also suggested that the number of internal examinations before actual university examination should be increased as it will help them to prepare the entire syllabus in appropriate time. Almost 93% of the students liked our tradition of paper discussion once after completion [Table 4]. We could not find any Indian study which took an elaborated feedback on assessment, its importance, and required modifications even after an extensive search. But, we strongly recommend that the weightage of internal assessment marks must be increased to a considerable degree as well as formative assessment in routine teaching-learning should find its due place in assessment scheme, because learning in histopathology is not only in cognitive domain but also it cannot be assessed in 3 h in a university paper.

Regarding existing second year curriculum, 77% of the students suggested that number of theory lectures should be increased. Most of the students (72%) demanded for vertical as well as horizontal mode of integrated teaching [Table 5]. Most of the students suggested increasing the case-based studies over didactic lectures, group discussion for active participation of as many students as possible, integrated teaching for more effective learning, and conducting quizzes so as to have a healthy competitive environment and fun-filled learning. Similar findings have already been suggested by numerous studies,^[10,12,13,15,18,19] which favored the above-mentioned methods of teaching, which are widely prevalent in western and developed countries. In India, problem-based learning is still limited to particular subjects or topics of a few institutions. Departmental autonomy, attitude of faculty members,

faculty shortage, and lack of resources are few among many reasons behind a slow change in the direction of active, student-oriented, and competency-based learning.^[20,21] The medical educationalist Ananthakrishnan^[21] has quoted that the shortage of medical teachers throughout India is 30–40% below the optimum level, which leads to failure to implement many educational innovations.

CONCLUSION

Our study has emphasized the importance of pathology as a subject for understanding clinical subjects and significance of different teaching modalities and underlines the need of a few changes in the teaching–learning process and assessment criteria as per student's perception. Recent rapid improvement in technology has offered many challenges in medical education. We must keep exploring the innovations and modify our approach of teaching according to students' need. However, such androgonic shift from traditional didactic lectures to a need-based approach requires a fundamental change of the roles and commitments of not only educators but also planners and policymakers.

As NMC has implemented its competency-based curriculum from 2019 batch onwards, this elaborative study can act as a baseline to evaluate the effectiveness of new curriculum in coming years.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Shah A, Shethwala N, Parmar B. Perception of undergraduate medical students towards the subject of pathology at one of the medical colleges of Gujarat, India. *Int J Med Sci Public Health* 2014;3:863.
- Dick F, Leaven T, Dillman D, Torner R, Finken L. Core morphological concepts of disease for second-year medical students. *Hum Pathol* 1998;29:1017-20.
- Domizio P. The changing role of pathology in the undergraduate curriculum. In: Hall PA, Wright NA, editors. *Understanding Disease: A Centenary Celebration of the Pathological Society*. London: Wiley; 2006. p. 137-52.
- Herrmann FE, Lenski M, Steffen J, Kailuweit M, Nikolaus M, Koteeswaran R, *et al.* A survey study on student preferences regarding pathology teaching in Germany: A call for curricular modernization. *BMC Med Educ* 2015;15:94.
- Husain M, Khan S. Students' feedback: An effective tool in teachers' evaluation system. *Int J Appl Basic Med Res* 2016;6:178-81.
- Karimi R. Interface between problem-based learning and a learner-centered paradigm. *Adv Med Educ Pract* 2011;2:117-25.
- Al Khader A, Obeidat FN, Abu Shahin N, Khouri NA, Kaddumi EG, Al Qaqa S, *et al.* Medical students' perceptions of pathology and a proposed curricular integration with histology: A future vision of curricular change. *Int J Morphol* 2020;38:38-42.
- Carr BM, O'Neil A, Lohse C, Heller S, Colletti JE. Bridging the gap to effective feedback in residency training: Perceptions of trainees and teachers. *BMC Med Educ* 2018;18:225.
- Tuma F, Nassar Ak. Feedback in Medical Education [Updated September 27, 2020]. StatPearls. Treasure Island, FL: StatPearls Publishing; 2021. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK544311>.
- Vijayan P, Ponniah A. A survey study based on undergraduate medical students' feedback regarding pathology and the teaching-learning methodologies employed. *Trop J Pathol Microbiol* 2017;3:149-54.
- Toppo NA, Lazarus M, Seth RJ, Bhargava OP, Yadav KS, Kasar PK. Introduction of integrated teaching learning module in second M.B.B.S. curriculum. *Int J Contemp Med Res* 2016;3:1275-9.
- Rafique N. Introducing integrated practical examination for 2nd year MBBS class. Proceedings in the 7th GCC Medical Colleges Conference by Saudi Society. *J Fam Commun Med* 2009;17:17-9.
- Emerald NM, Han TZ, Oo SS. Student's perception on effectiveness of pathology teaching in phase 1 medical programme at UCSI University. *Int J Med Sci Educ* 2016;3:264.
- Goyal M, Bansal M, Gupta A, Yadav S. Perceptions and suggestions of 2nd professional MBBS students about their teaching and learning process: An analytical study. *Natl J Integr Res Med* 2010;1:20-4.
- Quadri S, Srujana S, Mahesh S, Bheeshma B. Undergraduate medical students' feedback and perceptions on teaching learning methodology in pathology at Government Medical College. *Int Arch Integr Med* 2016;3:28-35.
- Moxham BJ, Emmanouil-Nikoloussi E, Brenner E, Plaisant O, Brichova H, Kucera T, *et al.* The attitudes of medical students in Europe towards the clinical importance of histology. *Clin Anat* 2017;30:635-43.
- Epstein RM. Assessment in medical education. *N Engl J Med* 2007;356:387-96.
- Dandannavar VS. Effect of integrated teaching versus conventional lecturing on MBBS phase I students. *Recent Res Sci Technol* 2010;2:40-8.
- Nikam LH, Chopade SV. Introduction of horizontal integration and comparison with traditional teaching methods in physiology. *Int J Basic Med Sci* 2012;3:143-7.
- Singh A. Student performance and their perception of a patient-oriented problem-solving approach with audiovisual aids in teaching pathology: A comparison with traditional lectures. *Adv Med Educ Pract* 2011;2:9-15.
- Ananthakrishnan N. Medical education in India: Is it still possible to reverse the downhill trend? *Natl Med J India* 2010;23:156-60.