

# Perception of First Year Medical Students towards a New Histology Module in a Medical College in Eastern India: A Quasi-experimental Study

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## ABSTRACT

**Introduction:** The post-COVID (Coronavirus) era, the transition of our country towards a competency-based curriculum, and our fundamental goal to improve students' learning experience and academic performance expedite the need to introduce new strategies to the existing teaching-learning method based on principles of medical education in the form of a structured module. Among all subdivisions of anatomy, this is especially relevant for histology because microscopic anatomy poses a basic difficulty associated with the comprehension of microscopic details of human tissues through the novice, untrained eyes of the freshly-admitted first-year medical students.

**Aim:** To study the perception of first year medical students towards the new histology teaching module.

**Materials and Methods:** This quasi-experimental study was conducted among 85 first year medical students of Medical College, Kolkata, from May 2022 to October 2022, on histology teaching methods, comparing new histology modules versus traditional histology methods. A student survey was conducted to study their perception regarding the difficulties faced by them during their first-semester histology practical examination. After conducting a literature search, a new learner-centered histology module was designed and implemented among students to address these difficulties. Forty-eight histology sessions were

conducted using the new module over a total duration of six months. Students' feedback regarding the new module was recorded at the end of the sixth month. The collected data was analysed using Statistical Package for the Social Science (SPSS) software version 22.0 (trial version).

**Results:** A total of 84 (98.8%) of students strongly agreed that because of the preliminary self-study time followed by discussions, quizzes, and brainstorming during the histology sessions, they had an improved understanding of the assigned learning areas. Additionally, 81 (95.3%) of students strongly agreed that their drawing skills of histology diagrams had improved due to drawing practice during the sessions. Furthermore, 83 (97.6%) of students reported an improvement in focusing and correctly identifying slides. Moreover, 82 (96.4%) of students felt that the regular formative assessments and immediate feedback improved their readiness for histology examinations. All of them agreed to the continued practice of the new module in future histology sessions.

**Conclusion:** The students' response towards the module was found to be positive. Addressing the students' recommendations in the future would increase the chances of generating more support for it and enhancing their motivation towards improved academic performance in histology examinations.

**Keywords:** Active learning, Medical science, Students perception, Spotting

## INTRODUCTION

Histology holds a unique position in the medical curriculum since ages and has progressed forward in leaps and bounds over the years with different advancements in the medical sciences [1]. In India the implementation of the Competency-Based Medical Education (CBME) curriculum initiated an urgent necessity to introduce changes to the present model of teaching histology [2,3]. Instead of using traditional didactic lectures followed by viewing of the designated glass slides, if interactive teaching-learning methods laid down in the CBME booklet [4] were incorporated into histology sessions, it would induce active learning and deep learning of histology by students, which would also enable them to correlate histology with pathology of tissue specimens in the future.

Additionally, if formative assessments followed by immediate feedback were introduced, this would ensure increased student involvement [5] and might improve their feedback-seeking behaviour, exam preparedness as well as their academic performance over time. Importance should also be given to learners' needs [6] as this would boost student motivation and would, in turn, serve to improve their academic performance in histology.

The post-COVID-19 era, in itself, is a major challenge for many students because of their sudden exposure to a new curriculum in a new environment after a prolonged period of online classes and home isolation during the COVID-19 era. A crucial problem area for the newly admitted first-year students' (untrained eyes), is spotting the anatomical details of tissues as required of them in histology sessions and examinations.

In order to address these issues and smooth the transition of first-year medical students into histology, a survey was conducted to earmark the areas of difficulty they faced in histology examination and classes. A new learner-centric teaching module, based on the study of Bloodgood RA, was customised according to the students' needs and was conceptualised by researchers of the present study and introduced among them over a duration of six months [6]. In conformation with the elements of the CBME module [4], it combined active learning and self-directed learning exercises along with formative assessments and feedback for histology. Also, students were made to practice on focusing and identification of slides, as well as illustrations of the histology slides, in order to prepare them for histology examinations, as this was an area of difficulty revealed from students' pre-intervention

feedback. Repeated literature searches revealed no such learner-centric module combining all these elements of the CBME module among previous studies in a similar setting and region.

The primary aim of the present study was to study the effectiveness of the new histology teaching module from the perspective of first year medical students at Medical College, Kolkata. The secondary objective of the study was to determine the improvement in understanding of assigned learning areas and to observe the improvement in drawing skills, focusing, and identification of histology slides from the students' perspective.

## MATERIALS AND METHODS

This quasi-experimental study was conducted among the students of the first professional MBBS batch of 2021-2022 for a duration of six months, from May 2022 to October 2022, at Medical College, Kolkata, which has an annual student intake capacity of 250.

The study population was initially taught histology using the conventional histology teaching method during the first semester. Following the first semester histology practical examination, a survey was conducted among 202 students to record their perception regarding the difficulties faced by them during the examination as well as their areas of weakness in histology according to them. A new histology module, designed based on the principles of the CBME curriculum, was introduced. The module design underwent peer review, and Institutional ethical clearance was obtained (MC/KOL/IEC/NON-SPON/1520(01)/08/2022).

A total of 48 histology sessions were conducted using the new module over a duration of six months. At the end of six months, students' perceptions regarding the new histology module compared to the traditional histology teaching method were obtained through pre-validated, semi-structured, printed questionnaires distributed to them at the end of histology class hours. Prior to the introduction, the questionnaires designed by the researchers of the present study were evaluated by five experts for content validity. The content validity index was calculated to be 0.8. A pilot study was conducted among 20 students to determine the reliability of the questionnaire, and Cronbach's alpha coefficient was calculated to be 0.9 [7]. The questionnaires consisted of four sections:

Part A: Students' personal information (5 items),

Part B: Study views (5 items),

Part C: Problems they faced with the new module and their solutions (6 items),

Part D: Their future recommendations to improve the effectiveness of the new module (4 items).

Parts A and B included close-ended, multiple-choice type, and Likert scale questions, whereas parts C and D included open-ended questions.

**Sample size calculation:** The sample size was calculated using the formula:

$$n = Z_{\alpha}^2 \times P \times (1-P) / L^2$$

n=Minimum sample size

P=Prevalence level of perceived benefits of the histology module=50%

(In the absence of any previous study on the pros and cons of the new histology module, the prevalence level of its perceived benefits was presumed as 50% to ensure the maximum sample size).

Q=Complement of P=100-P=50%

$Z_{\alpha} = 1.96$  (considering a 95% confidence interval, two-tailed)

L=Absolute error of 10%

Putting the values,  $n = (1.96^2 \times 50 \times 50) / 10^2 = 96$ , i.e., approximately 100

So, the minimum sample size is 100.

N=Finite population=250

Applying Finite Population Correction (FPC) (as  $n/N = 0.40$ , which is more than 0.05), the sample size of intervention was revised using the following formula of FPC:

$$FPC = \sqrt{\{(N-n)/(N-1)\}} = \sqrt{\{(250-100)/(250-1)\}} = 0.77 \text{ (N=Finite population size=250)}$$

The revised minimum sample size is  $(100 \times 0.77) = 77$

Assuming a 10% non response rate, the final minimum sample size will be  $(77 + 7.7) = 85$

Thus, 85 students were selected by simple random sampling using the lottery method to ensure equal representation from students and to prevent bias.

**Inclusion criteria:** All first year medical students, Batch 2021-2022, studying at Medical College, Kolkata, who were willing to participate in this study and willing to give their informed consent were included in the study. Also, students who had at least 75% attendance in histology classes during the given study period (accepted as a base level after discussion with other faculty members of the Anatomy department) were also included in the study.

**Exclusion criteria:** Students who had less than 75% attendance in histology classes during the given study period and those who were unwilling to participate in the study were excluded.

Elements of the new module [Table/Fig-1] included dedicated self-study time followed by interactive sessions, projection of images of displayed slides with clarification of points of identification, practice of focusing and identification of slides, as well as drawing and labeling of projected histology slides and formative assessments with constructive feedback. [Table/Fig-2] highlights the main differences between the pre-existing method of teaching histology and the new histology teaching module.

At the onset of the study, a survey was carried out among students regarding their difficulties [Table/Fig-1] in histology examinations and

Students' difficulties/problems as per students' survey (n=202)	Element of new module	Underlying principles of CBME curriculum
Difficulty in recall during histology practical examinations. n=91 (45%)	Study of topic prior to attending class+dedicated self-study time of designated learning areas during session.	To promote self-directedness of learners and reinforcement of learning.
Difficulty in answering conceptual questions during histology practical examinations. n=95 (47%)	Self-study time followed by interactive sessions (brainstorming and quizzing).	Active learning+deep learning exercises.
Difficulty in identification of histology slides. n=107 (53%)	PowerPoint projection of images of displayed slides and clarification of points of identification.	Concept-clearing.
Difficulty in focusing of histology slides. n=103 (51%)	Practice of focusing and identification of histology slides.	Addresses problem area pointed out by students.
Difficulty in drawing and labelling of projected histology slides. n=117 (58%)	Practice of drawing and labelling of projected histology slides.	Addresses problem area pointed out by students.
Need for more preparedness to face histology practical examinations. n=83 (41%)	Formative assessments followed by constructive feedback.	To promote self-directed learning and deep learning.

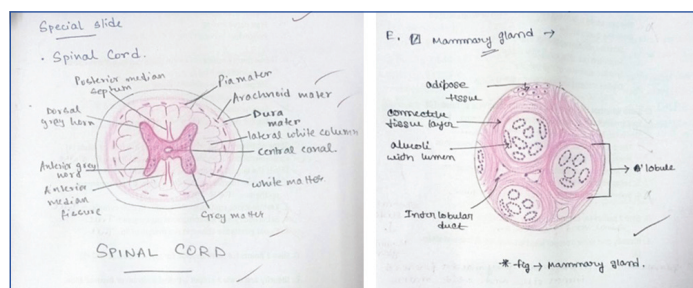
**[Table/Fig-1]:** Elements of new module (with specific underlying principles of CBME curriculum used) and students' difficulties during first semester histology practical examinations (as per frequency of students' responses) addressed by them.

Pre-existing histology teaching method	New histology teaching module
Lecture followed by viewing of designated histology slides.	Dedicated self-study time of designated learning areas followed by interactive sessions (brainstorming and quizzing).
Drawing of histology slides at home with submission of histology files in the successive session.	Practice of drawing and labeling of projected histology slides during session. Drawings by students taken by facilitator at the end of the session as exit ticket.
Internal assessment+summative assessments.	Formative assessments with feedback+internal assessment+summative assessments.

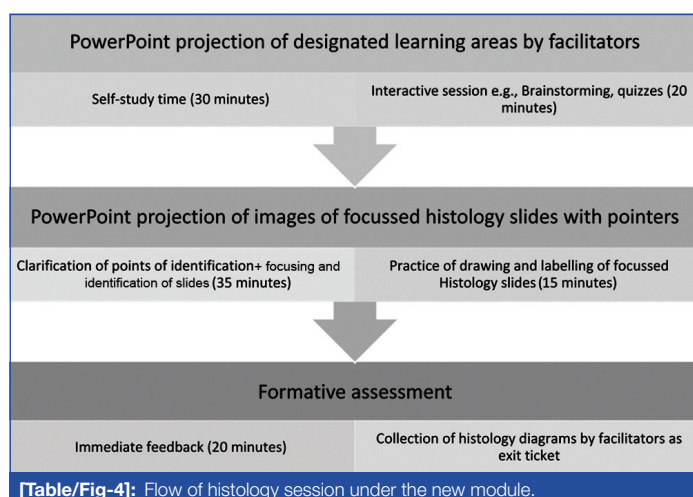
**[Table/Fig-2]:** Differences between pre-existing histology teaching method and new module.

classes. A learner-centric, interactive histology teaching module was conceptualised based on the study by Bloodgood RA, incorporating elements of the CBME module, which were introduced among students [3,6].

A total of 48 histology sessions were conducted using the new module over a duration of six months (May 2022-October 2022). Students were asked to study the histology topic before attending the sessions. According to the module, each two hour histology session was divided into dedicated self-study time of 30 minutes, interactive sessions of 20 minutes, PowerPoint projection of images of focused slides with clarification of points of identification, viewing of slides under microscopes, practice of drawing and labeling histology slides, and formative assessment with immediate feedback [Table/Fig-3]. The format of the histology session according to the new module is illustrated in [Table/Fig-4].



**[Table/Fig-3]:** Drawings of histology slides by students.



**[Table/Fig-4]:** Flow of histology session under the new module.

Students' feedback regarding the new module was recorded at the end of the sixth month post-implementation using pre-validated questionnaires designed by the researchers. The questionnaires were printed in English language and circulated among the students at the end of the histology classes.

## STATISTICAL ANALYSIS

The collected data from the students' filled questionnaires were coded and entered into an MS Excel spreadsheet. The data were then transferred to IBM SPSS software version 22.0 (trial version) for further analysis.

## RESULTS

The study was conducted on 85 first professional MBBS students with an average age of 19.235 years. Of these, 59 (69.4%) were males and 26 (30.6%) were females. A total of 84 (98.82%) students agreed that the new histology module led to improved understanding of histology compared to the old method of teaching. Additionally, 83 (97.6%) students said it improved their focusing and correct identification of slides, 81 (95.3%) students felt it enhanced their skills of drawing histology diagrams, and 82 (96.4%) students believed it increased their preparedness for histology exams. However, four students disagreed that the new histology module led to an improvement in their drawing skills of histology diagrams [Table/Fig-5].

Study views	Strongly agree n (%)	Disagree n (%)	Undecided n (%)
Improved understanding of histology	84 (98.8%)	0	1 (1.2%)
Improved drawing skills of histology diagrams	81 (95.3%)	4 (4.7%)	0
Improved focussing and correct identification of slides	83 (97.6%)	2 (2.4%)	0
Better preparedness to face histology examinations	82 (96.4%)	1 (1.2%)	2 (2.4%)

**[Table/Fig-5]:** Students' study views towards the new module as compared to the pre-existing method of teaching histology (N=85).

The problems reported by students during the implementation of the new module mainly included less time to prepare the topic 31 (36.5%), long duration of classes 14 (16.5%), less time for discussion of exam questions and doubt-clearing 14 (16.5%), difficulty bringing study materials to class 13 (15.3%), less time to draw slides 10 (11.7%), less time to prepare for formative assessments 7 (8.2%), and difficulty in the identification of slides 6 (7%). The solutions offered by students to these problems mostly included the announcement of histology topics beforehand and better time management 36 (42.4%), more time for exam-oriented discussions and doubt-clearing 18 (21.2%), frequent revisions and tests 9 (10.6%), reduced duration of class 8 (9.4%), and exam-oriented handouts 8 (9.4%) [Table/Fig-6,7].

Students' problems	Student responses n, (%)
Less time to prepare histology topic	31 (36.5)
Long duration of classes	14 (16.5)
Less time for discussion of exam questions and doubt-clearing	14 (16.5)
Difficulty to bring histology study materials to class	13 (15.3)
Less time to draw slides	10 (11.7)
Less time to prepare for formative assessments	7 (8.2)
Difficulty in identification of slides	6 (7)
No problems faced	5

**[Table/Fig-6]:** Students' problems during implementation of new module as per frequency of responses (N=85).

Solutions	Student response n (%)
Prior announcement of histology topics and better time management	36 (42.4%)
More time for discussion of exam-oriented discussions and doubt-clearing	18 (21.2%)
Frequent revisions and tests	9 (10.6%)
Reduced duration of class	8 (9.4%)
Exam-oriented handouts	8 (9.4%)
Provision of study materials and simple histology diagrams	6 (7%)
Drawing practise initiated by teacher	5 (5.8%)
Others (e.g., happy acceptance of new method after few sessions, study sessions with breaks in between, shift of histology class to first half of day etc.)	10 (11.7%)

**[Table/Fig-7]:** Students' suggestions for resolution of problems faced during practice of new module as per frequency of responses (N=85).

All the students unanimously agreed that in the future they would prefer the practice of the new histology module instead of the conventional method of teaching histology. Additionally, their future recommendations for the new histology module largely included frequent tests 17 (20%), frequent revision classes 16 (18.8%), doubt-clearing sessions 14 (16.5%), more time for preparation of all topics 8 (9.4%), and emphasis on slide identification 5 (5.8%) [Table/Fig-8].

Recommendations	Student responses n (%)
Frequent tests	17 (20%)
Frequent revision of previous classes	16 (18.8%)
Doubt-clearing session	14 (16.5%)
More time to prepare all topics	8 (9.4%)
Emphasis on slide identification	5 (5.8%)
Improved quality of slides	5 (5.8%)
Importance to be given to concept-clearing, speed in identifying slides, 3D models	4 (4.7%)
Simple diagrams for drawing with drawing practise to be initiated by teacher	4 (4.7%)
Explanatory short notes to be provided	3 (3.52%)
Theory should be followed by self-study and discussion	3 (3.52%)
Quiz with prizes	3 (3.52%)
Emphasis on applied histology	2 (2.35%)
Self-monitoring by students	2 (2.35%)
Lecture handouts	2 (2.35%)
Chalk and talk	2 (2.35%)
Soft copy of study material and H&E pencils to be circulated	2 (2.35%)
Others	
One topic per class	1 (1.2%)
Correlate with theory topic	1 (1.2%)
More time for preparation before assessment	1 (1.2%)
No recommendations	5 (5.8%)

**[Table/Fig-8]:** Students' future recommendations for the module (N=85).

The results show that the new histology teaching module may be used to teach histology in the future because of promising responses from students. Additionally, further improvements may be made to make it more learner-centric and bridge the gap between students and teachers by incorporating students' solutions to their problems and future recommendations, as feasible.

## DISCUSSION

The results of the present study revealed that the new histology teaching module, compared to the pre-existing teaching method, was able to provide an improved understanding of histology and refined skills of drawing and identification of focused histology slides, as perceived by students.

Students' viewpoint plays a significant role in guiding them towards their academic success [6]. Additionally, the post-COVID era has necessitated the introduction of innovative methods to teach Anatomy, including histology [7]. Studies conducted to observe students' perception towards the traditional method of teaching histology found that students were enthusiastic about trying out learner-centric, modern methods of teaching histology [8-11]. In this context, Selvig D et al., conducted a study to identify students who were likely to face difficulties in learning histology by examining their educational background, study habits, and use of resources [12]. Similarly, the present study was carried out in the wake of the COVID-19 pandemic to identify students' perception of the difficulties they faced during histology classes and examinations. The goal was to address and resolve these difficulties to improve their academic performance. As the National Medical Council aimed to shift towards a competency-based curriculum, the new histology

teaching module incorporated principles of the CBME curriculum such as active learning and formative assessments.

Similar to the studies by Bloodgood RA et al., and Jurjus RA et al., the present study developed a learner-centric model for histology, utilising group activities to engage students [6,13]. Additionally, like the study by Bloodgood RA, dedicated time for self-study was incorporated [6].

This study adopted the principles of Fu X et al., study, which introduced a learner-centric multi-dimensional approach to teaching Anatomy to overcome the disadvantages of the conventional teacher-centric approach, such as passive learning and lack of interaction [5]. Fu X et al., received overwhelmingly positive responses from their students, which was also reflected in their academic scores [5]. Moreover, to address students' difficulties in interpreting histology images, students were given practice in illustrations, focusing, and identification of histology slides to prepare them for histology examinations, as this was an area of difficulty identified from students' feedback.

The current research involved the design and implementation of a histology teaching module similar to the studies by Tendolkar VA and Shekokar AV; Schoenherr DT et al., and Chimmalgi M and Hortsch M [14-16]. Tendolkar VA and Shekokar AV, utilised classroom projection and emailing of histology slide images to students, receiving positive responses [14]. Schoenherr DT et al., adopted a modular approach to integrating histology and anatomic pathology, while Chimmalgi M and Hortsch M used self-directed learning modules with videos blended with traditional histology teaching methods [15,16]. In contrast, the present study included additional learner-centric elements based on principles of medical education and the CBME curriculum. Maske SS et al., in their study, observed the usefulness and perception of students towards the use of WhatsApp to learn histology and received a positive response from students [17]. Although the present study did not use WhatsApp to teach histology, a separate histology WhatsApp group was created to convey information regarding histology classes, share study materials and histology diagrams, and clarify students' doubts.

Although the studies by Parker EU et al., Koshi R et al., Beylefeld A et al., and Brisbane MAS et al., designed innovative histology teaching methods to address students' difficulty in the interpretation of histology images, the emphasis laid by the present histology module on the identification as well as the practice of illustrations of histology slides was found to be missing in previous studies carried out in similar settings and regions [3,18-20]. Similar to the aforementioned previous studies, encouraging results were also obtained from students in the present study. Students' feedback revealed improved understanding of histology, increased skills in focusing and correctly identifying slides, as well as improved skills in drawing histology diagrams. They reiterated that the new module boosted their preparedness for histology exams.

Thus, the new learner-centric multi-element histology module, comprising interactive histology sessions, an emphasis on drawing practice and correct identification of histology slides, along with formative assessments with feedback, can be recommended as a promising alternative to the current method of teaching histology, with suitable improvisations based on students' problems and recommendations. Moreover, after implementation in different centres, further studies can be undertaken to explore whether there is any positive correlation between the module and students' academic performance in histology examinations.

## Limitation(s)

The present histology module was implemented in only one medical college in Eastern India. This may affect the representation of Eastern India. It would be relevant to study with a larger sample size and less margin of error.

## CONCLUSION(S)

The new module was found to be effective, as it was perceived by students to increase their exam preparedness through improved understanding of histology, better drawing skills, and correct identification of histology slides. Future addressing of feasible solutions and recommendations made by them would increase the chances of generating more support towards it, as well as increasing their motivation to perform better in histology exams.

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