

Histology's PATH(ology): Evaluating Structured Pathology Modules Within First Year Medical Student Histology Instruction

Uchenna Ozuzu, MBS, OMS III and Marina D'Angelo, Ph.D

Department of Biomedical Sciences, Philadelphia College of Osteopathic Medicine

INTRODUCTION

Histology serves as a critical foundation for medical education, yet many medical students struggle to bridge the gap between recognizing normal structures and identifying pathological abnormalities. To address this challenge, we developed learning segments within the active learning platform, TopHat, designed to reinforce histological pattern recognition and its application in pathology. The goal is to develop a stronger foundation in recognizing disease manifestations at the histological level as this would serve a transformative asset in students' clinical skills.

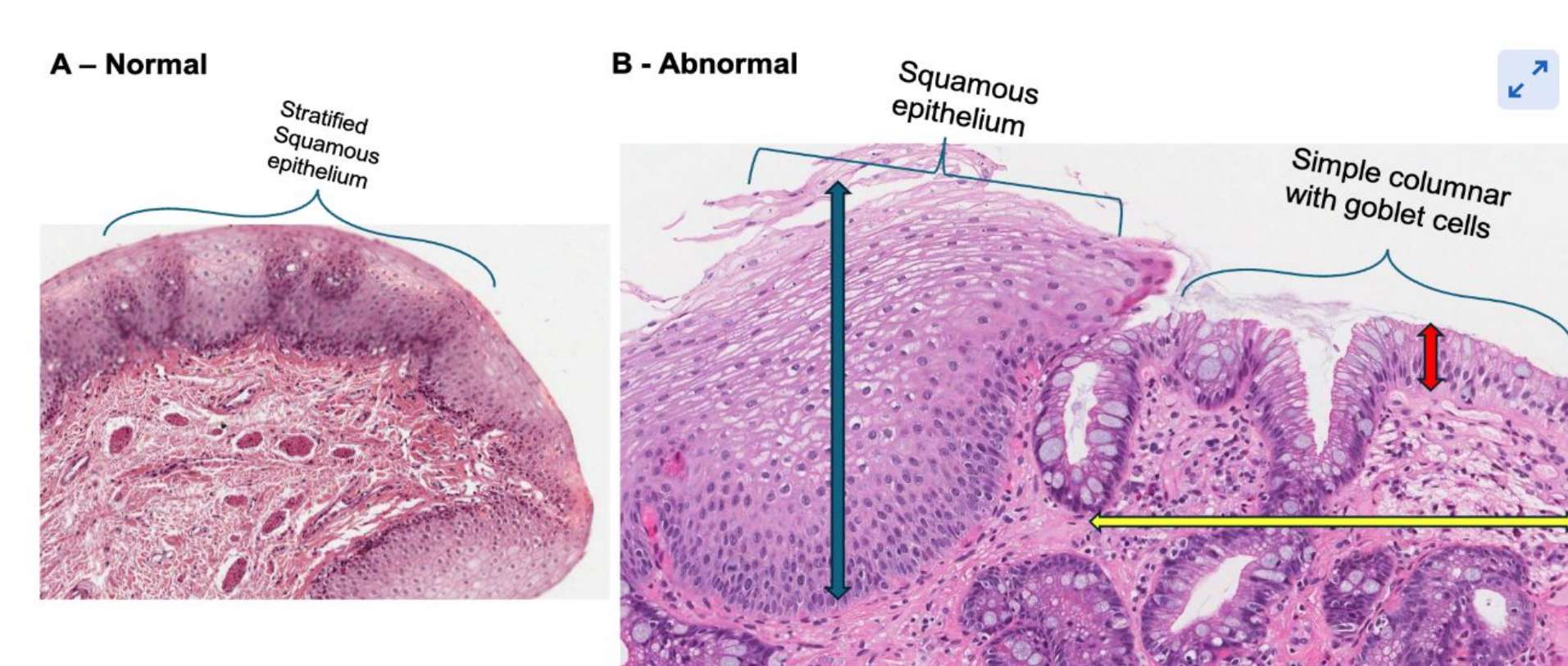
OBJECTIVE

This study assesses the effectiveness of these learning segments in improving first-year (DO) osteopathic medical students' confidence and competence in histology at the Philadelphia College of Osteopathic Medicine (PCOM).

METHOD

The curated Histology's PATH(ology) learning segments complement the histology lab study modules (faculty-curated on TopHat) for the four fundamental tissue types: Epithelium, Connective Tissue Proper (including the specialized connective tissues, Cartilage and Bone), Muscle, and Nervous tissue. Each learning segment compares the normal appearance of tissues and the cellular structures of the tissue to the abnormal pathology. Labeling tools outline the differences allowing students to compare and contrast what to find and identify when comparing normal with abnormal histology. This same template was implemented to highlight different disease pathologies and reinforce the application of finding histological differences in abnormal tissues and making clinical inferences.

CASE #2: Barrett's Esophagus



The esophagus is lined by a thick stratified squamous epithelium (Panel A). The defining features of the esophagus transitioning into Barrett esophagus is the presence of the simple columnar epithelium (Panel B) with goblet cells that matches the lining of the early portion of the stomach, extending into the distal part of the esophagus. This histological feature represents the continuous acid reflux that occurred causing the cells to take on a new form with the constant erosion of the stratified squamous epithelium.

References:

1. https://www.researchgate.net/figure/Histology-normal-esophageal-mucosa-HE-staining_fig1_373470730

Figure 1: Example of the learning segment implemented into each fundamental tissue types module. This was a comparison of normal esophageal tissue versus abnormal tissues which is *Barrett's Esophagus*. Resources utilized include Web Pathology, Pathology Outlines, peer-reviewed research articles, and Robbins Basic Pathology (1-3).

We measured student satisfaction with the Histology's Path(ology) learning segments through a vetted survey (4). The IRB approved survey was administered to the Class of 2028 and the Class of 2029 cohorts at the Philadelphia College of Osteopathic Medicine at the conclusion of their first year of study of normal histology.

RESULTS & DISCUSSION

To evaluate the impact of the *Histology's PATH(ology)* learning segments, we conducted a modified Likert-scale survey to assess student satisfaction with supplemental online learning segments. This survey was initially administered to the Class of 2028. To build upon these findings, we subsequently distributed the same survey to the Class of 2029, while incorporating a novel longitudinal component aimed at evaluating the sustained educational impact of these modules on the Class of 2028 as they progressed into their second-year curriculum. This phase of training places greater emphasis on pathophysiology and the consistent recognition of pathological processes.

First-year osteopathic medical students in the **Class of 2029 at Philadelphia College of Osteopathic Medicine were surveyed, with 129 students responding. Results were comparable to those observed in the Class of 2028 (234 respondents)**, demonstrating a response rate exceeding 80% satisfaction with the learning modules. The survey, administered during Term 3 following completion of the standard histology curriculum, evaluated domains including ease of use, comprehension, and perceived educational effectiveness of the *Histology's PATH(ology)* segments. Responses were collected anonymously via Google Forms and analyzed using Microsoft Excel. Overall, findings indicate that student satisfaction with both usability and content quality fell within the high to very high range.

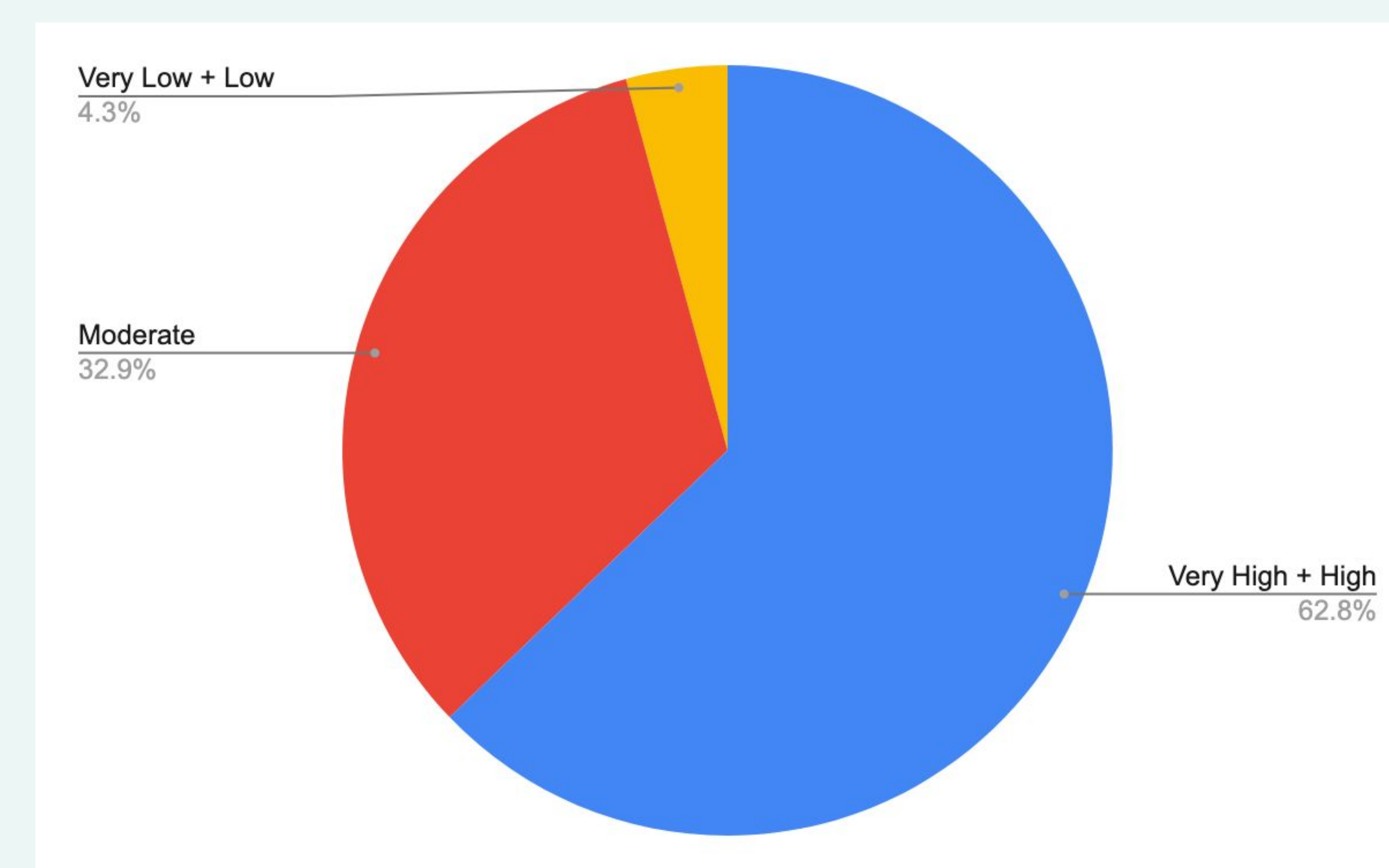


Figure 2: Total Overall Satisfaction ratings for both Class of 2029 and Class of 2028 - The survey (4) was administered at the completion of the study of the histology discipline in M1 year of medical school at PCOM.

A key advancement in this study was the integration of a longitudinal performance analysis assessing the academic outcomes of the Class of 2028 during their second-year coursework. This analysis examined exam performance on specific pathology questions in the core systems-based course, Clinical Gastrointestinal System (Clinical GI), block to determine whether early exposure to structured histology-pathology integration translated into improved recognition and application of pathological concepts.

Clinical GI Performance	Overall Average	Average per Question	Upper Third	Lower Third
Without Module	81%	80.12%	91.53%	69.47%
With Module	81.5%	84.29%	94%	73.71%

This addition represents a critical contribution to the study, as it moves beyond subjective satisfaction metrics to objectively evaluate educational outcomes. The findings aim to elucidate the foundational role of early histologic training in reinforcing diagnostic reasoning and enhancing performance in pathology intensive curricula, thereby underscoring the long-term value of integrating clinically oriented histology exposure early in medical education with pathology topics.

CONCLUSION

- Based on the results of our student satisfaction survey, these learning segments complement the existing histology laboratory TopHat learning modules and can support students' education by providing a step forward in recognizing medical diseases more accurately through a strong background in histology.
- Based on preliminary review of student class performance on pathology test questions, access to the learning segments seems to improve overall image recognition in testing.
- Findings from this study can help determine whether structured pathology modules enhance student engagement, improve histopathological interpretation, and better prepare students for board exams, clinical research, and future medical practice.
- This initiative represents a step toward modernizing histology education and reinforcing its role in medical training.

Table 1: Clinical GI Pathology Questions from the exams that had histology images associated with them were used in the calculations presented in Table I. There were three quizzes and two exams for each cohort utilized for the averages calculated. The total number of questions were n=14. Data is presented for a representative cohort that did not receive the Histology's Path(ology) learning segments (Without Module) and one that did receive them (With Module). Percentages presented in each column are for the average for all tests and quizzes in the course. Upper and Lower third represent the percentage of students that performed well on each test and within the questions on each test.

REFERENCES

1. Quer M, Hernandez-Prera JC, Silver CE, Casasayas M, Simo R, Vander Poorten V, Guntinas-Lichius O, Bradley PJ, Tong-Ng W, Rodrigo JP, et al. Current Trends and Controversies in the Management of Warthin Tumor of the Parotid Gland. *Diagnostics*. 2021; 11(8):1467.
2. <https://www.webpathology.com/case.asp?case=109> (last accessed April 2, 2025).
3. https://www.researchgate.net/figure/Histology-normal-esophageal-mucosa-HE-staining_fig1_373470730 (last accessed April 2, 2025).
4. Antonio O. Ganub, "A Survey on Students' Satisfaction in Self-Learning Modules," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 5, Issue 3, pp. 156-159, 2022.

ACKNOWLEDGEMENTS

Thank you to the Department of Bio-Medical Sciences for the financial and in-kind support of this project.