



# Histology education in an integrated, time-restricted medical curriculum: Academic outcomes and students’ study adaptations

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## INTRODUCTION

Understanding of histology is a key foundation in medical education.

Technological advances such as virtual microscopy and other online resources have transformed histology education and been introduced to replace the old lecture and light microscope format.

The University of Michigan Medical School (UMMS) revamped the histology curriculum in 2016 by reducing the histology content for theory and practical sessions, quizzes and the examination questions by three-fold.

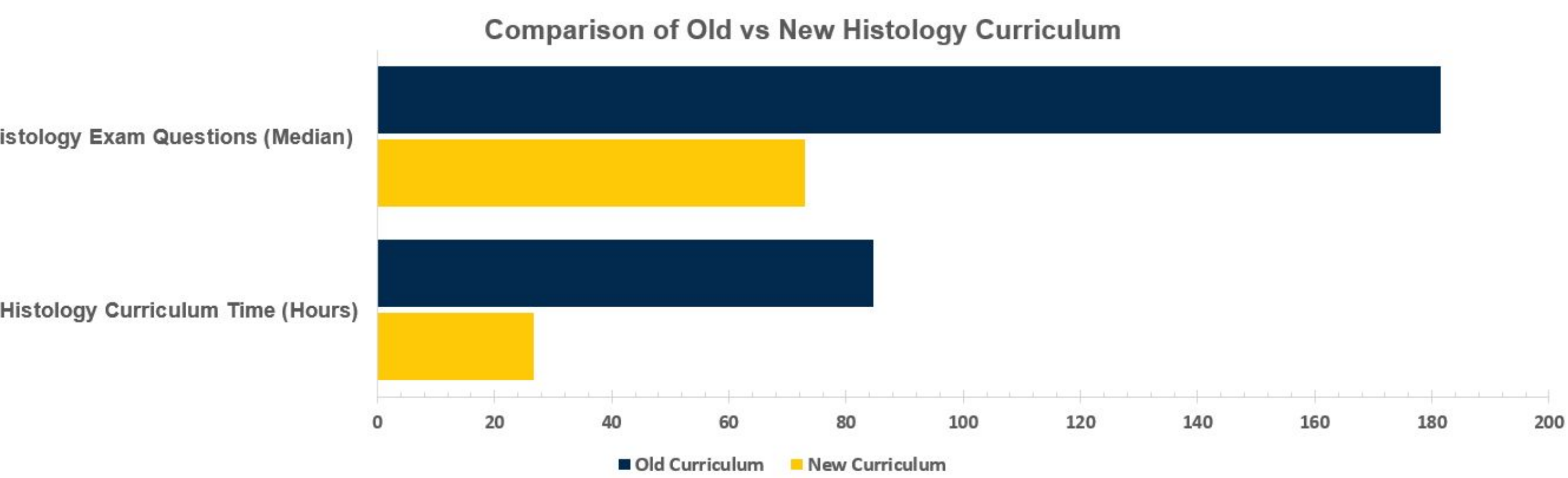


Fig 1. Comparison of the old versus new UMMS histology curriculum

## STUDY OBJECTIVES

- Primary Outcome
- To find out if the significant reduction in histology teaching time affected the **histology knowledge and skills** of students.
- Secondary Outcomes
- To find out how the changes in curriculum affected students
  - **Attitudes towards histology**
  - **Histology learning strategies**
  - **Use of educational resources**

FEATURES	OLD CURRICULUM	NEW CURRICULUM
Lectures	✓	✓
Laboratory Sessions	✓	
Michigan Histology Website	✓	✓

## METHODS

The study population included US MD UMMS M1 students from both the old curriculum (2010-2016) and the new curriculum (2016-2019)\*.

Qualitative and quantitative data was collected from both the cohorts. The quantitative data comprised of students’ performances in histology as well as histology lecture and lab hours. The qualitative data comprised of their attitudes toward learning histology, as well as time devoted to histology study and corresponding resource usage. Data collected also attempted to explain the drop in grades, including educational background, study preferences, time spent studying and prioritisation of histology.

*\*The authors did not report qualitative data from 2010-2012, as well as the 2017 cohort.*

## RESULTS

Measure of Academic Performance	New curriculum	Old curriculum	p-value
Average TOTAL examination score	89.98	89.86	0.81
Average HISTOLOGY questions score	81.15	87.73	0.004*
Percentage of students with a substandard Histology score (<75%)	36.3%	2.3%	0.0017*

Fig 2. Table comparing academic performance of students in new versus old curriculum

Possible explanatory variables	Students under the new curriculum have ... compared to students under the old curriculum	p-value
Quality of lecturers (measured via Lecturer Evaluation Score, 1 = low; 5 = high)	Higher lecturer evaluation scores (4.41 ± 0.01 compared to 3.96 ± 0.24)	0.005*
Attitude towards histology	Increased perceived relevance of histology to their future career as physician	0.0028*
Study Time	Decreased percentage of students spending more than 3 hours of study time per histology lecture topic Increased percentage of students spending less than 1 hour of study time per histology lecture topic	0.001*
Use of Michigan Histology Website	Decreased use of Michigan Histology website and other supplementary learning resources	Not stated
Preference for consuming histology lecture videos	Increased preference to consume histology lecture videos	0.0037*
Preference for attending in-person histology lectures	No difference	0.2722
Preference to study alone	No difference	0.4882
Preference to study with others	No difference	0.5162

Fig 3. Table showing possible variables to explain the decreased histology performance

There is an significant decrease in histology scores among students in the new curriculum (Fig 2), with a massive increase in the proportion of students with substandard histology scores. The disparity was found to be the largest among students from the worst performing quartile of each cohort (Fig 4).

Possible factors that may account for the decrease in academic performance includes (Fig 3):

Decreased estimated study time per histology topic

Decreased utilisation of the Michigan Histology website

Increased preference to consume histology lecture videos

Quartile	Old curriculum	New curriculum
Top Quartile	~95	~90
2nd Quartile	~90	~85
3rd Quartile	~85	~80
Bottom Quartile	~80	~70

Fig 4. Graph showing histology scores stratified by class quartiles

Students in the new curriculum viewed histology as an important component of their medical education more significantly more than students in the old curriculum.

## DISCUSSION

- Even though students in the new curriculum reported an increased quality of lecturers and greater importance of histology, other factors ultimately led to an overall decrease in histology academic performance. These factors include:
- Lack of enforcement to watch didactic lectures online, coupled with lack of laboratory experiences leading to less time spent on studying histology.

Lack of sub-scores for histology performance in the new curriculum could contribute to lack of feedback on performance for newer batches.

Reduction in number of examinable histology questions in the new curriculum reduces students’ motivation to study histology.

Lack of guidance using resources such as Michigan Histology website discourages time spent on it, since active interpretation is required.

## LIMITATIONS

Lack of transferability to Singapore context due to different school systems.  
Risk of recall bias which may influence questionnaire responses.

## CONCLUSION

A combination of different teaching methodologies (didactic and laboratory) can improve students’ proficiency in histology.