

# The Efficacy of Pre-Lab Assignments in First Year Medical Student Gross Anatomy



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## Introduction

Over the past several decades, medical schools across the globe have transitioned from traditional medical school curricula to curricula that emphasize active-learning through problem-based learning and flipped classroom models. In the past, PowerPoint presentations were used in the University of Colorado School of Medicine anatomy block to present the cardiovascular and lymphatic systems. With the curriculum reform starting for the class of 2025, the former “circulatory tools” no longer align with course objectives, thus fostering the need for new, active learning pre-lab assignments to be completed on an individual basis prior to its presentation in gross anatomy education. Current research supports the use of pre-lecture assignments for improving student learning outcomes, long-term retention, student confidence, and promotes self-regulated behaviors (Dunlosky et. al., 2003).

This project aims to implement interactive pre-work modules that align with the Trek Curriculum (TC) and assess the efficacy of the pre-assigned material qualitatively, via medical student perception and satisfaction with the learning modules, and quantitatively by evaluating student exam learning outcomes.

## Methods - Pre-Lab Module Development

H5P, an online platform used to create, share, and reuse HTML5 content was used to create weekly, interactive learning modules aligning with the University of Colorado School of Medicine’s TC learning objectives.

Each week, learning objectives (LOs) were placed into four categories:

- Nervous system
- Cardiovascular system
- Regional anatomy
- “Other”

Ten interactive nervous system directed pre-lab modules were created using:

- Clear objectives that align with course content
- Active recall.
- Spaced Repetition
- A variety of H5P content types including
  - Integrated videos and animations
  - Layered “agamotto” images
  - Fill in the Blank
  - Drag-and-Drop
  - Multiple choice and mini quizzes

## Methods - Data Analysis

**Qualitative:** To assess student perception, open-text responses from weekly surveys were collected and categorized to create a qualitative thematic analysis. Feedback was de-identified, evaluated, and utilized to edit and improve pre-work modules with the goal of continuously creating a user-friendly, engaging experience for medical students.

**Quantitative:** To assess student learning outcomes, analytics were continuously captured through H5P and analyzed for student performance. While students were only graded for completion, a cut-off score on the end-of-assignment quiz of 60% was used as the benchmark for appropriate module interaction for analytical purposes.

## Results - Student Performance

System	Module	LOs	Percent of Class Scoring >60%
Foundations	Module 1	2	86.2
	Module 2	1	84.7
GI	Module 3	1	60.3
	Module 4	2	43.5
CardioPulmonary	Module 5	1	55.4
	Module 6	2	58.1
Neuro	Module 7	1	47.8
	Module 8	1	45.1
MSK	Module 9	1	41.3
	Module 10	1	28.8

Table 1: Class of 2025 Pre-Work Completion Rate by Module

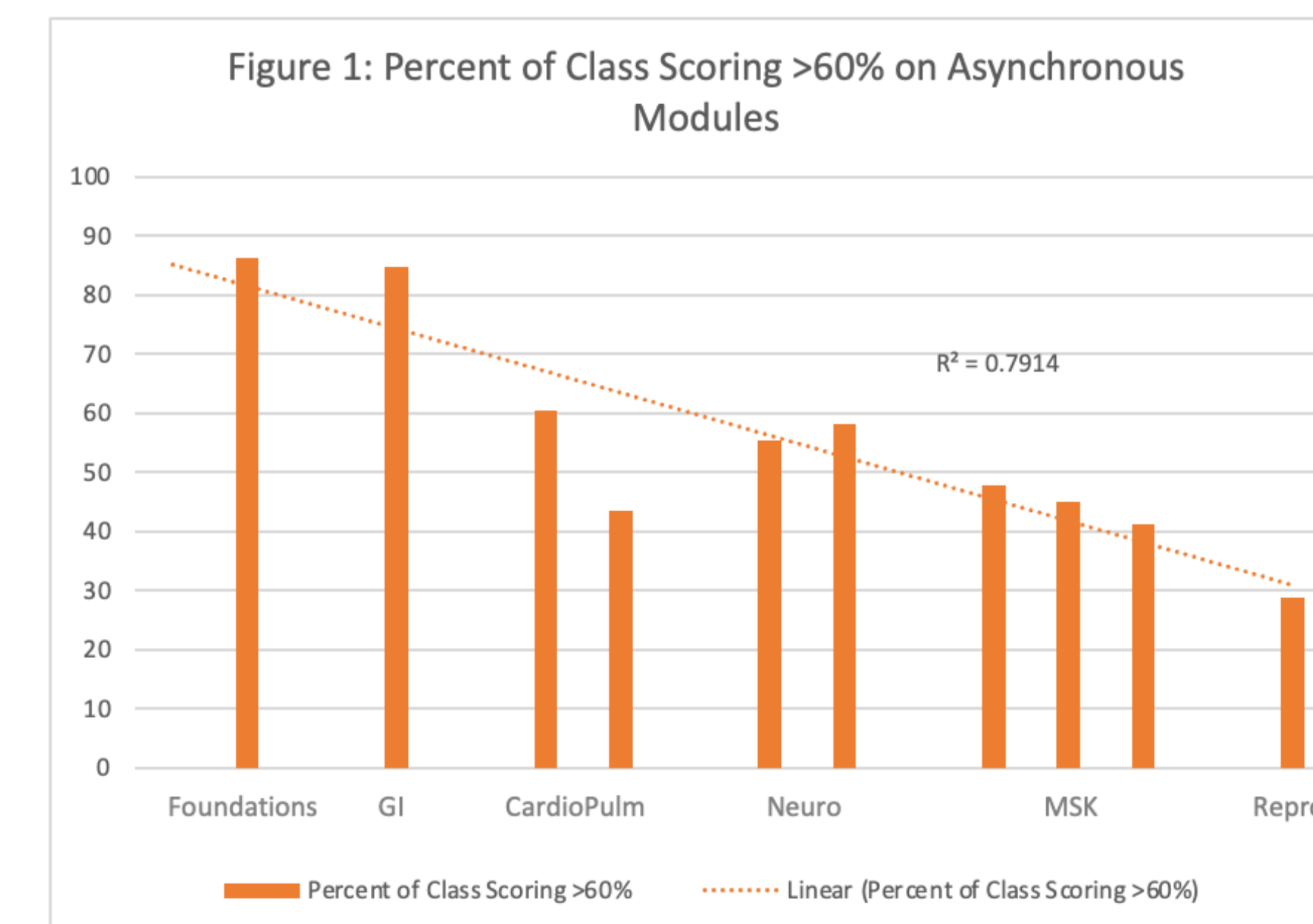


Fig 1: Class of 2025 Pre-Work Completion Rate: A measurement of pre-work interaction using a cut-off of 60% on the end-of-pre-work quiz as passing for appropriate interaction for each module.

## Results - Student Feedback

Open-text feedback submitted in weekly and end-of-course surveys fell into three general themes: user experience, content structure and relevance, time management, and learning preferences. Overall, students shared that the prework successfully introduces the material prior to lecture and enhances their comprehension of basic cardiovascular, nervous, and regional anatomy topics; however, there were concerns about the relevance of prework to the week’s material and appropriate time management to complete the pre-work. Students favored tools that were simple to understand and engage with, had explicit instructions, were visually appealing, and promoted active learning. Modules that seemed repetitive, had more complex instructions, and required lower levels of engagement were viewed less favorably.

	Not at all	Slightly	Moderately	Very	Extremely	Total	
	6	45	59	35	13	158	
HL Week 1		1	1			2	HL = Hematology and Lymphatics
HL Week 2		1				1	PCV = Pulmonary and Cardiovascular
PCV Week 1				1		1	RU = Renal and Urinary
PCV Week 2			1			1	NV = Nervous
PCV Week 3			2			2	MSI = Musculoskeletal and Integumentary
PCV Week 4			1			1	RLC = Reproductive and Life Cycles
PCV Week 5		1	1	2	1	5	
PCV Week 6			3	1		4	
RU Week 1	1	2	3	4		10	
RU Week 2				1		1	
RU Week 3			1			1	
RU Week 4			1			1	
NV Week 1			1	2	3	6	
NV Week 2			2	2	3	7	
NV Week 3		1	3	2	1	7	
NV Week 4			3	4	1	8	
NV Week 5		1			1	2	
MSI Week 1		10	10	3		23	
MSI Week 2	2	11	10	7	1	31	
MSI Week 3	3	10	7	1	1	22	
MSI Week 4		4	1	1		6	
RLC Week 1			3	3	1	7	
RLC Week 2		1	5	1		7	
RLC Week 3		1				1	
RLC week 4		1				1	

Table 1: Responses to the prompt “Rate the overall effectiveness of the pre-work in helping you understand the material from the lectures and be prepared for small group sessions”

## Conclusions and Discussion

- Introducing complex concepts in medicine through interactive learning modules is an effective way to increase student engagement and perceived comprehension of these concepts.
- When the open-text feedback was broken down by system block and week, weeks with a higher response rate, such as MSI, correlated with a larger number of negative comments and lower survey ratings for perceived pre-work efficacy. Analogously, weeks with lower response rates had a larger percentage of positive comments and higher survey ratings.
- Student interaction with pre-assigned learning appears to decrease with curriculum progression with a moderate correlation.

## Limitations

- H5P modules are user generated, thus it is difficult to compare the TC pre-work modules outlined in this study to others documented in the literature.
- H5P cannot require a specific grade (e.g. 75%) to trigger activity completion, thus a student who clicks through the module will have the same completion status as another student who received a perfect score.
- Utilizing survey results and free response replies to assess satisfaction and perceived benefit introduces a risk of researcher bias, recall bias, and non-response bias.
- Student learning outcomes may be affected by a significant amount of confounding variables including:
  - Perceived lecturer teaching efficacy for associated L.O.s, (may produce variability in student performance on LOs not associated with our assigned modules)
  - The use of third-party educational resources not integrated within the school’s curriculum
  - Differences in difficulty between learning objectives
  - Synchronous session attendance.

## Acknowledgements

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## Disclosures

We certify that they have NO affiliations with or involvement in any organization or entity with any financial or non-financial interests in the subject matter or materials discussed in this project.

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