Imaging-Based Modules for Musculoskeletal Anatomy and Pathology in Preclinical Medical Education

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INTRODUCTION:

Many medical students and orthopedic surgery residents report a lack of adequate orthopedic and musculoskeletal (MSK) teaching in the preclinical medical curriculum. Seeing gross anatomy is emphasized in pre-clinical education; students may feel a disconnect from clinical anatomy proficiency. Moreover, medical students report being underprepared to assess imaging pathology in clinical clerkships. The purpose of this project is to assess the efficacy of a preclinical image-based module to teach MSK anatomy and pathology concepts to preclinical medical students.

METHODS:

Two image-based modules for the back and upper limb were created utilizing H5P software for second- year medical students in the MSK course. The modules integrated the anatomy and MSK imaging with pathology taught within the course. The modules were hosted on students learning management systems and provided a highly interactive and engaging interface with practice questions, active recall exercises that incorporate high yield image based MSK anatomy and orthopedic concepts alongside radiological imaging, illustrational anatomy, and cross-sectional cadaver images from the Visible Human Project ®. Study participants included all the students enrolled in the MSK course and were recruited via email on a voluntary basis. Student performance on each module was collected and compared to performance on the MSK course assessments. The study was approved and conducted in accordance with the institutional review board.

RESULTS:

76 of 122 (62%) students in the MSK course utilized the upper limb module and 55 (45%) students utilized the back module, showing a high participation rate despite the availability of the abundant supplementary educational resources for preclinical courses. Students who used the upper limb module scored 2.9 points higher on average (p=0.046), in the MSK written assessment when compared to their peers who did not use the module, and students who used the back module scored 1.5 points higher (p=0.362).

DISCUSSION AND CONCLUSION:

An imaging-based module integrating MSK concepts with imaging is a valuable tool to allow medical students to learn musculoskeletal anatomy and related orthopedic concepts at their own pace. Increasing exposure to cross-sectional anatomy with imaging may help students better transition from preclinical anatomy knowledge to clinical application. While the data reached statistical significance only for the upper limb module, there is a positive trend in assessment performance for all students who used the modules. Anecdotal evidence from student feedback also supports student preference for module-based learning over traditional modes of studying MSK material. These findings should encourage other medical curricula to further explore the integration of image-based module learning into preclinical education. Future investigations are needed to better explore subjective feedback from students and analyze subject-specific efficacy of image-based module learning.
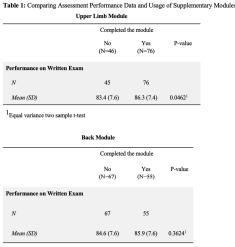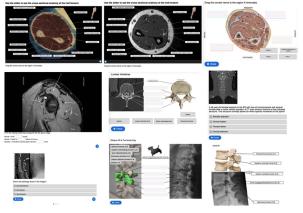
Table 1: Comparing Assessment Performance Data and Usage of Supplementary Modules

Upper Limb Module

	Completed the module		
	No (N=46)	Yes (N=76)	P-value
Performance on Written Exam			
N	45	76	
Mean (SD)	83.4 (7.6)	86.3 (7.4)	0.0462[1]

[1]Equal variance two sample t-test

Back Module

	Completed the module		
	No (N−67)	Yes (N−55)	P-value
Performance on Written Exam			
N	67	55	
Mean (SD)	84.6 (7.6)	85.9 (7.6)	0.3624[1]

[1]Equal variance two sample t-test

Figure 1: Examples of Interactive Activities from Modules