

Perception of Pathology of Otolaryngology-Related Subjects: Students' Perspective in an Innovative Multidisciplinary Classroom

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Aim: Multidisciplinary, as a term, is used to define people from different scientific backgrounds working together, each drawing on their field of expertise. Some related terms are frequently used interchangeably, such as interdisciplinary and transdisciplinary, but they are confusing and ambiguous. Introduction of a multidisciplinary teaching method in the early phases of medical curricula is insufficient for effective learning. Here, we aim to implement a multidisciplinary approach in the early phase of medical education and identify outcomes.

Methods: Two groups were evaluated in this study, each representing phases II and III of the Albaha medical curriculum, and including 90 and 86 students, respectively. "Hearing tests and their clinical applications" was selected as a subject to evaluate the understanding of special senses as studied by the phase II group, while "pathology of otolaryngology-related tumors and clinical correlations" was selected as a subject to evaluate the understanding of otolaryngology as studied by the phase III group. These subjects were selected by faculty members from otolaryngology, pathology and physiology departments and taught in successive stations. Teaching sessions were followed by a formative test that included 10 multiple-choice questions and a mini-clinical evaluation exercise (mini-CEX). A questionnaire to evaluate student satisfaction was completed after the exam.

Results: Students' satisfaction for the "hearing tests and their clinical applications" and "pathology of otolaryngology-related tumors and clinical correlations" subjects were 80% and 90.5%, respectively. The formative assessment revealed good student performance at 63.28%, and 60.46% of all students in both phases attained scores above 80%.

Conclusion: Introduction of a multidisciplinary approach early in the medical curriculum improves knowledge and skill acquisition. This is reflected in student performance, especially if evaluated using the mini-CEX format, thus providing rapid feedback to students concerning their performance.

Keywords: integration, multidisciplinary, mini-CEX, otolaryngology, pathology, student performance

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Introduction

Integrated curricula have been extensively implemented due to widespread dissatisfaction with the teaching of basic sciences as unrelated disciplines with no connection to clinical practice.¹ Conventional instructional tools no longer meet existing needs in multidisciplinary and interdisciplinary medical training settings.^{2,3}

At the same time, advocates of cognitive learning suggest that integrated advances in schooling offer imperative benefits for active learning and knowledge retention

as content application and contextualization are encouraged. Networks that motivate effective clinical interpretation are thus additionally supported.⁴⁻⁷ Terms such as multidisciplinary, interdisciplinary, and transdisciplinary are ambiguously defined and commonly used, accurately or not, interchangeably.⁸ Multidisciplinary, as a term, defines people from different scientific backgrounds working together while individually drawing on their field of expertise.^{9,10} In such a multidisciplinary approach, both students and instructors are motivated to connect seemingly different subject areas and work together to plan and present lessons that focus on a central theme.^{11,12}

A multidisciplinary level of integration, as described by Harden,¹⁴ is opposite that of the word “webbed” introduced by Fogarty¹⁵ as it considers different subject areas to be the center of student learning to approach a particular set of problems, topics or subjects. Central subjects in an integrated module may serve different purposes. These subjects can define an area in which pragmatic decisions have to be made and hence serve as a crucial point for interdisciplinary judgment.

In the integrated Albaha medical school curriculum, we adopted the first eight levels of integration established by Harden et al¹⁴ (ie isolation, awareness, harmonization, nesting, temporal coordination, sharing, correlation, and complementation) and introduced multidisciplinary, interdisciplinary, and transdisciplinary levels into clinical practice. Aiming to improve student performance with minor curricular reforms,¹⁶⁻²⁰ we selected the multidisciplinary level to be the one first evaluated. The aim of this study was to introduce and assess the multidisciplinary approach to teaching at the Albaha medical school curriculum by selecting subjects taught during different phases of medical education. Student and peer feedback was evaluated to establish an improved action plan for implementation in the near future.

Materials and Methods

This study was performed after receiving permission from the Quality Unit of the Albaha Faculty of Medicine, Saudi Arabia. A written agreement was also obtained from all of the participating students included in this study.

This study was performed during the teaching of special senses and otolaryngology modules, mapped in phases II and III of the medical program, respectively. As a component of continuous curriculum reform, the medical education and quality units started to implement the multidisciplinary approach in all program modules; special senses and

otolaryngology modules were mapped to phases II and III of the medical curriculum, respectively, and evaluated as upcoming modules. A committee was formed encompassing staff from medical education, quality, and special senses and otolaryngology departments that decided on a process of teaching delivery after consultation with instructors. Subjects were to be selected in a multidisciplinary context. After evaluating teaching materials of both special senses and otolaryngology modules, both modules were selected after consultation with instructors. Learning outcomes were optimally matched with teaching strategies. Subject contents are detailed in [Tables 1](#) and [2](#). These two subjects were selected considering the availability of teaching and learning resources in pathology and physiology labs, as well as diverse clinical and imaging modalities available within the otolaryngology department. The “hearing tests and their clinical applications” subject was taught to 90 students (60 male and 30 female), thus representing evaluation of the entire class studying the module in phase II of the medical curriculum. The “pathology of otolaryngology-related tumors and clinical correlations” subject was taught to a class of 86 students (58 male and 28 female) as part of the otolaryngology module taught in phase III of the medical curriculum.

Learning outcomes for both subjects were assessed by faculty members from the three aforementioned departments; findings were also reviewed by the medical education unit.

Teaching of the “hearing tests and their clinical applications” module started with identification of the physiological basis and interpretation of hearing tests whilst individually monitoring students. The second station, taught by pathology faculty, clarified disease pathogenesis and etiologies of hearing loss. The third station, taught by otolaryngology faculty, instructed students how to perform a practical hearing examination including the utilization of imaging modalities. These stations were taught in two practical skill rooms (skill-labs) while the entire class was divided into two main groups. Each group was further subdivided into three subgroups circulating in one direction, starting from the physiology station and finishing at the otolaryngology station. The students spent 40 minutes in each station followed by a 15-minute break.

In the “pathology of otolaryngology-related tumors and clinical correlations” subject, basic pathology was taught in parallel with clinical and radiological applications. Both topics were taught by pathology and otolaryngology experts. Teaching was delivered in the skill-lab over three sessions, two hours each in duration. Each session

Table I Data for the “Hearing Tests and Their Clinical Applications” Module Taught to Phase II Medical Students

Station	Title	Important Items	Instruction
Physiology	Types of hearing tests	1. Speech tests 2. Tuning fork tests 3. Pure tone audiometry	The physiology instructor exhibits the types and physiological basis of different hearing tests and how to perform each test and observe the student for their performance
	Physiological basis of hearing tests	Normal auditory pathway and mechanism of hearing, alteration in hearing loss	
	How to perform different types of hearing test?	Tools used and conditions	
Pathology	Types of hearing loss	Conductive, sensorineural hearing loss, bilateral and unilateral	The pathology instructor does overview on the pathogenesis including types, etiology related to external, middle and inner ear with histopathological examples for exostoses, osteomas, cholesteatoma and glomus tumors, neuroma
	Pathogenesis of conductive hearing loss; external ear and middle ear	Complete occlusion of the ear canal by cerumen, foreign bodies in the external auditory canal, otitis externa, exostoses and osteomas, perforations of the tympanic membrane by chronic otitis media, middle ear effusions and trauma, cholesteatoma myringosclerosis of the tympanic membrane, otosclerosis glomus tumors	
	Pathogenesis of sensorineural hearing loss	Hereditary and non-hereditary congenital hearing loss, Noise-induced traumatic loss, Presbycusis Autoimmune hearing loss Perilymph fistula Meniere's disease Acoustic neuroma, ototoxin exposure	
Otolaryngology	Questions for evaluating hear loss	When did your hearing loss begin? Was your hearing loss sudden, or has your hearing slowly been getting worsens? Does your hearing loss involve one or both ears? Have you been having ringing in your ear, fullness in your ear, dizziness, ear drainage, or ear pain? Is there a history of hearing loss in your family? What is your job? What is the noise level in your workplace? Do you have a history of ear infections, ear injury, or straining to hear? What medicines are you currently taking? Have you received any intravenous antibiotics, diuretics, salicylates, or chemotherapy?	The otolaryngology instructor exhibits the important questions during history taking and clues to the diagnosis of conductive and sensorineural hearing loss
	Clues to the diagnosis of conductive hearing loss	History, physical examination and suggested cause of conductive hearing loss	
	Clues to the diagnosis of sensorineural hearing loss	History, physical findings, audiogram, and suggested cause of sensorineural hearing loss	
Otolaryngology/ imaging	Investigation needed	Laboratory and radiologic	The otolaryngology/imaging instructor exhibits the important imaging modalities and important findings

consisted of two successive stations; in the first station students studied the pathogenesis and morphology (gross and microscopic images) of otolaryngology-related tumors using materials distributed by a pathology instructor. In

the second station, clinical and radiological assessments were made by an otolaryngology instructor. These two stations were taught in the skill-lab and the entire class was divided into two main groups, further subdivided into

Table 2 Data for the “Pathology of Otolaryngology-Related Tumors and Clinical Correlations” Module Taught to Phase III Medical Students

Station	Title	Important Items	Instruction
Pathology	Ear tumors	Tumor-like lesions such as epidermal cyst; benign tumors like naevi and squamous cell papilloma; and malignant tumors such as basal cell carcinoma, squamous cell carcinoma and malignant melanoma. Aural (otic) polyps, cerumen-gland tumours, cholesteatoma (keratoma). Jugular paraganglioma Acoustic neuroma (acoustic schwannoma).	The pathology instructor does overview on the tumors and tumor-like lesion of ear, nose, pharynx and larynx. The pathology instructor focus on the pathogenesis and morphology of the most specific and common tumors related to ear, nose, pharynx and larynx.
	Tumors of the nose	Capillary haemangioma, sinonasal papillomas, olfactory neuroblastoma and sinonasal carcinomas	
	Tumors of the pharynx	Nasopharyngeal angiofibroma, nasopharyngeal carcinoma, embryonal rhabdomyosarcoma, malignant lymphoma	
	Tumors of the larynx	Laryngeal papilloma and papillomatosis laryngeal nodules laryngeal carcinoma	
Otolaryngology	Clues to the Diagnosis of tumors related to ear, nose, pharynx and larynx	History, physical examination and laboratory and radiological investigation and management.	The otolaryngology instructor exhibits the important questions during history taking and clues to the diagnosis of tumors and exhibit diverse imaging modalities for the most common tumors related to ear, nose, pharynx and larynx

two subgroups circulating in one direction, starting from the pathology station and ending at the otolaryngology station. The students spent 40 minutes in each station followed by a 15-minute break.

At the end of the multidisciplinary station, an exam consisting of 10 multiplechoice questions (MCQs) for each subject was administered. Exam questions were formed from scenario-based material covering all subject learning outcomes. Exam MCQs of the “hearing tests and their clinical applications” module consisted of three physiology questions, three pathology questions and four otolaryngology questions. Exam MCQs of the “pathology of otolaryngology-related tumors and clinical correlations” module consisted of five pathology questions and five otolaryngology questions, including radiological content.

Following the MCQ exam, a mini-clinical evaluation exercise (mini-CEX) was administered and consisted of four stations for each module. In the “hearing tests and their clinical applications” module, the first station evaluated student performance of different hearing tests in real patients; the second station evaluated diagnosis of a hearing problem in a standard patient; the third station evaluated student interpretation of

gross and microscopic otolaryngological specimens; the fourth station evaluated student ability to formulate a management plan for the disorder in the third station. In the “pathology of otolaryngology-related tumors and clinical correlations” module, the first station evaluated student history taking skills via interaction with a patient simulating otolaryngological tumor symptoms; the second station evaluated student performance of physical and local head and neck examinations on a manikin with neck swelling; the third station evaluated student skills in the diagnosis of otolaryngological tumors both grossly and microscopically; the fourth station evaluated student skills in interpreting radiological data collected via different imaging modalities. In all stations, students were evaluated according to well-prepared checklists tailored for each station; each carried 5 marks. Station data are summarized in [Table 3](#). Students were quickly provided with individualized, written feedback at the end of examination. We administered the mini-CEX as previously reported.^{21–24}

Upon module completion, degree of student satisfaction was evaluated. Questionnaires structured separately for each module were designed by a committee composed of faculty members from pathology, physiology and otolaryngology

Table 3 Mini-Clinical Evaluation Exercise Data (Mini-CEX) for Both Modules

Subject	Stations of Mini-CEX			
	1	2	3	4
Hearing tests and its clinical application	Performance different hearing tests in real patient	Diagnosing the hearing problem in simulating patient	Students interpret with the gross and microscopic specimens of an otolaryngology disorders	Perform a management plan
Pathology of the otolaryngology-related tumor and its clinical correlation	Perform history taking from patient with otolaryngology tumor	How the students perform physical examination	Student' skills in diagnosing the otolaryngology tumor grossly and microscopically	Student' skills in measuring the radiological skills using different imaging modalities

departments. Questions were formulated and revised thoroughly by an educational specialist and a small pilot study evaluating groups composed of junior faculty members and students were performed to support reliability. During each module, a questionnaire was distributed to all the students included in this study. The questionnaire used was quantitative and consisted of a 5-point Likert scale^{25–27} collecting information concerning student satisfaction regarding the teaching of subjects as a multidisciplinary learning approach. Questionnaires measured the degree of satisfaction among participants with values of 5 (strongly satisfied), 4 (satisfied), 3 (neutral), 2 (dissatisfied), and 1 (strongly dissatisfied).^{16–19,25–27}

Results

Students' satisfaction and formative assessments were very impressive. Satisfaction on the "hearing tests and their clinical applications" revealed that 63 out of 90 (70%) students were strongly satisfied, 14 (15.5%) were satisfied, 5 (5.6%) were neutral, 4 (4.4%) were dissatisfied, and 4 (4.4%) were strongly dissatisfied.

In the "pathology of otolaryngology-related tumors and clinical correlations" module, findings revealed that 60 out of 86 (69.7%) students were strongly satisfied, 6 (6.97%) were satisfied, 5 (5.8%) were neutral, 8 (9.3%) were dissatisfied, and 7 (8.13 %) were strongly dissatisfied. These data are detailed in [Figure 1](#) and [Table 4](#). Formative assessment (consisting of the mini-CEX and 10-MCQ exam) data for both modules are summarized in [Table 5](#).

For the "hearing tests and their clinical applications" module, evaluation of student MCQ exam performance in physiology revealed that 60 (69.7%) of the students scored 3/3, 17 (19.7%) scored 2/3 and 9 (10.6%) scored 1/3. Evaluation of student performance in pathology revealed that 64 (74.4%) of the students scored 3/3 and 22 (25.6%)

scored 2/3. Evaluation of student performance in otolaryngology revealed that 62 (72%) of the students scored 4/4, 13 (15.1%) scored 3/4, and 9 (10.4%) scored 2/4 and 2 (2.3%) scored 1/4.

For the "pathology of otolaryngology-related tumors and clinical correlations" module, evaluation of student performance in pathology revealed that 65 (72.2%) of the students scored 5/5, 16 (17.8%) scored 4/5 and the remaining 9 (10%) scored ≤ 3 . Evaluation of student performance in otolaryngology revealed that 66 (73.3%) of the students scored 5/5, 16 (17.8%) scored 4/5 and 8 (8.8%) scored ≤ 3 .

Student performance on the mini-CEX was evaluated using a checklist. For the "hearing tests and their clinical applications" module, student performance evaluation revealed that 63 (70%) of the students scored $\geq 4/5$ in the first station; 76 (84.4 %) of the students scored $\geq 4/5$ in the second station, 73 (81.1%) of the students scored $\geq 4/5$ in the third station, and 63 (70%) of the students scored $\geq 4/5$ in the fourth station. For the "pathology of otolaryngology-related tumors and clinical correlations" module, student performance evaluation revealed that 62 (72%) of the students scored $\geq 4/5$ in the first station, 69 (80.2%) of the students scored $\geq 4/5$ in the second station, 66 (76.7%) of the students scored $\geq 4/5$ in the third station, and 60 (69.7%) of the students scored $\geq 4/5$ in the fourth station.

Discussion

In our multidisciplinary approach, students and instructors were encouraged to join diverse subject areas and work together to map and present lessons that focused on a central theme.^{10–13}

Our study integrated otolaryngology, pathology, and physiology instruction so that teaching was delivered in successive stations by participating faculty from each discipline. This was achieved following the general outline

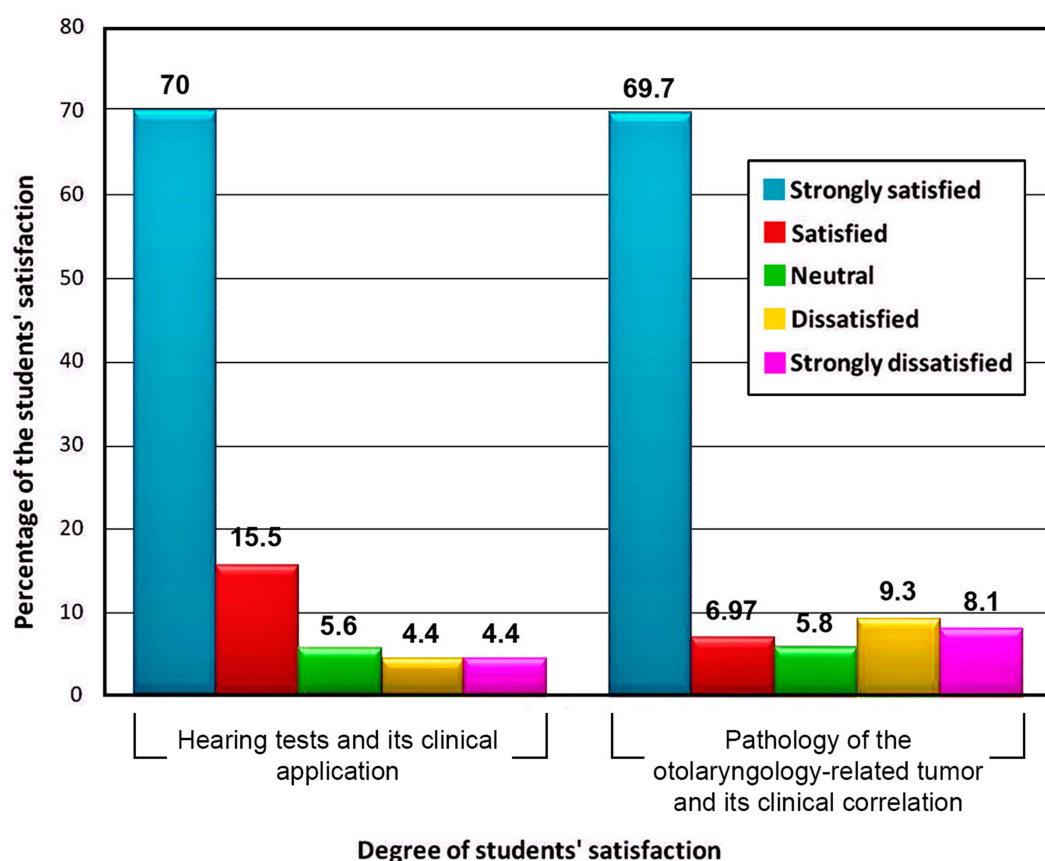


Figure 1 Graph represents the students' satisfaction against the multidisciplinary subjects of phase II and phase III.

concerning implementation of a multidisciplinary teaching approach as described by Harden.¹⁴

In order to monitor this newly adopted teaching methodology, students were administered a 10-question MCQ exam followed by a mini-CEX to assess their degree of acquired knowledge as well as cognitive and psychomotor skills. Students received feedback immediately after completing the exam as in other studies that used the mini-CEX assessment.^{21–24} The validity of data obtained from both assessment models was done through the followings; good feedback from the students and peers regarding the whole process and mode of assessment and from the psychometric studies such as item analysis and discrimination index and the data obtained was

within normal values. The introduction of both multiple-choice questions and mini-CEX at the end of the multidisciplinary sessions achieved all levels of the Miller' triangle,^{28,29} the multiple-choice questions used in this current methodology were based mainly on the first two levels know and knows how, while the show s how and does achieved through the mini-CEX. However it is recognized that mini-CEX only capture one element of evaluating clinical competency. In order to evaluate the full range of clinical competency multi-method assessments are required. By using MCQs beside the mini-CEX, the defects of individual assessment formats can be overcome. The addition of practical sessions in the mini-CEX, such as diagnosing a histopathological

Table 4 Student Satisfaction Data for a Multidisciplinary Approach to Teaching in Both Phases (Phase II and III) of the Medical Curriculum

Theme	Strongly Satisfied	Satisfied	Neutral	Dissatisfied	Strongly Dissatisfied
Hearing tests and its clinical application	63 (70%)	14 (15.5%)	5 (5.6%)	4 (4.4%)	4 (4.4%)
Pathology of the otolaryngology-related tumor and its clinical correlation	60 (69.7%)	6 (6.97%)	5 (5.8%)	8 (9.3%)	7 (8.1%)

Table 5 Mini-Clinical Evaluation Exercise and 10-Question Multiple-Choice Exam Performance Data for Both Modules

Students' Mark Out of 30	"Hearing Test and Its Clinical Application" Theme	"Pathology of Otolaryngology-Related Tumors and Its Clinical Correlation" Theme
27–30	13 (14.4%)	9 (10.46%)
24–26	44 (48.88%)	43 (50%)
21–23	23 (25.55%)	26 (30.23%)
18–20	4 (4.44%)	3 (3.48%)
15–17	3 (3.33%)	2 (2.32%)
≤14	3 (3.33%)	3 (3.48%)

specimen, integrated elements of basic science into the context of clinical examination. The spiral curriculum of the medical school mandates basic science teaching in all phases of the curriculum. Questionnaire data revealed that student satisfaction in this multidisciplinary approach was 85.5%, and 77% for both modules (as detailed in Figure 1 and Table 4). Our results were supported by both MCQ and mini-CEX formative assessment performance data (Table 5) that detailed students performance in each discipline separately as determined by thorough analysis of exam results. Our findings were consistent with those reported by Muller et al,³⁰ where effects of a multidisciplinary approach to introductory teaching of anatomical pathology and radiology were investigated. Course content was delivered by faculty from both disciplines and this approach garnered a highly positive response from the students. Similar results were also reported by Flaherty et al, Tawfek and Redick, Mihalik et al, and Galvin et al, who studied the diagnosis of pneumonia, breast cancer, benign breast lesions, and lung fibrosis using a multidisciplinary approach.^{31–34}

In order to differentiate between the terms multidisciplinary, interdisciplinary and transdisciplinary, Choi and Pak explained that a multidisciplinary approach represents utilization of knowledge gathered from diverse disciplines which, at the same time, is clearly classified as originating within the boundaries of their respective fields. The interdisciplinary approach integrates relationships between disciplines into coherent and coordinated processes. The transdisciplinary approach integrates health, social, and natural sciences in a humanities framework, exceeding the conventional boundaries of these fields by themselves.³⁵ These three terms refer to the contribution

of several disciplines in different quantities and contexts but on a similar scale.

Sorace et al³⁶ found that multidisciplinary integration is essential for attaining precise diagnoses and managing patients appropriately. Atta and AlQahtani³⁷ found that all integration across disciplines, especially in multidisciplinary and interdisciplinary manners, has major positive effects on learning outcomes. They thus recommended the adoption of such an approach for teaching of all content starting early in the curriculum. In addition, modification of teaching modalities and selection of appropriate integrative approaches, along with suitable alignment with relevant teaching/learning tools, has been reported to positively impact student achievement.^{38,39} Choi and Pak⁴⁰ also stated that disciplines that are more different from one another in nature and knowledge type are more likely to lead to novel approaches for composite objectives. The proposed theoretical framework of knowledge identifies many knowledge subsystems, each containing several disciplines. This inter-disciplinary divide direct selection of suitable disciplines for multidisciplinary instruction.

In some circumstances, task-based learning can be considered to be an example of a hidden multidisciplinary approach as it possesses multidisciplinary features in which learning is focused not only on ingenuity in task performance but also in skill building, thus increasing understanding of relevant basic and clinical sciences. There is continuous debate on this subject as task-based learning is mainly student-centered, whilst the multidisciplinary method is taught in a teacher-centered fashion with faculty members playing a major role in bringing their field of expertise to the course module.

Conclusion

Introducing a multidisciplinary integrated approach to teaching early in the medical curriculum positively impacts the acquisition of student knowledge and skills. This is reflected in student performance and achievement, especially if followed by mini-CEX assessment with rapid feedback sharing with students regarding their performance. Modification of the mini-CEX assessment in alignment with the academic curriculum warrants consideration, such as by introduction of practical sessions in a clinical context. Our findings revealed that student satisfaction was high in regards to our curricular modification and they strongly supported implementation of such a teaching approach in upcoming modules.

Disclosure

The authors report no conflicts of interest in this work.

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