Blended Learning for Larynx & Pharynx Anatomy

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SUMMARY

Larynx & Pharynx is an anatomically complex region of the body and important for medical students to grasp clinically. A challenge for multi-site institutions is maintaining consistency among locations while offering personalized learning experiences for all students. Blended learning can help address these both challenges. Here we describe a blended learning session on the topic of pharynx and larynx run at a multi-site medical school where all students viewed a custom pre-work video, then attended an in-class problem set with a local facilitator. Results show equivalent exam performance on larynx and pharynx summative assessment questions between campuses and high levels of learner satisfaction with the session.

PURPOSE

Larynx and pharynx is a complex area of the body anatomically, making it difficult to grasp in a single learning session. However, it is crucial for clinicians to understand the relationship between the pharynx, larynx, and digestive tract for procedures like intubation or endoscopy. Learning is enhanced when students are actively engaged with the material. One approach to active learning is a blended learning paradigm, which requires learners to complete online pre-work followed by in-person sessions with an instructor in which the students actively solve problems. Blended learning has been shown to help reduce achievement gaps[1], improve exam performance [2], increase student satisfaction and engagement [2,3], and help students solve more difficult problems involving analysis and evaluation[4]. Our institution, the Medical College of Wisconsin (MCW), has three sites: a main 4-year campus in Milwaukee and two 3-year regional campuses. A current challenge is balancing quality student interaction with consistency across sites. Our goal is to introduce innovative, active learning methods in which students engage with local faculty during "lecture time". This study evaluated student comprehension and satisfaction following a blended learning module on the topic of Larynx and Pharynx with a custom pre-work video followed by a local in-class problem set.

METHODS

The Medical College of Wisconsin (MCW) is a multi-site institution with three sites: a main 4-year campus in Milwaukee (MKE, n =208 students) and two 3-year regional campuses (Green Bay (GB), n = 25; Central Wisconsin (CW), n = 21). Our Clinical Human Anatomy course is taught by anatomical region. Learning sessions are primarily didactic and livestreamed from the main campus to the regional campuses in addition to being recorded for later viewing. By contrast, in the 2019-20 academic year, we utilized a blended learning paradigm for the topic of larynx and pharynx during the Head and Neck unit of the course. In both cases, learners completed cadaveric dissections with local instructors following "lecture time".

PRE-WORK:

- Required: Custom made video accessed through Learning Management System, Brightspace **(Fig. 1A)**. Video illustrated and narrated by the TNP, available on YouTube https://www.youtube.com/watch?v=zytXay5C3p4&t=12s
- Optional: "check your understanding" activities consisting of labeling worksheets and practice application questions (**Fig. 1B**)

IN-CLASS PROBLEM SET (90 minutes):

- Facilitation: TNP facilitated sessions with MCW-MKE (in the room) and MCW-GB (remote), while JDF facilitated sessions with MCW-CW (in the room).
- Format: Some questions required students to respond via the Audience Response System, TopHat, while discussion questions were answered verbally using the think/pair/share format.
- Problem set: questions increased in difficulty as the session progressed, eventually having students solve complex clinical problems (**Fig. 2A-B**)

ASSESSMENT:

- Exam questions for this topic were set at varying Bloom's taxonomy levels. Low (level 1) and high (level 3-4, i.e. learning outcome 6)
- Aggregate data of performance on the whole exam and larynx & pharynx-specific questions was compared between campuses by One-Way ANOVA with Tukey's post test. Results were considered statistically significant when $p < 0.05$.
- A follow-up survey was given via Qualtrics to assess student perception of the blended learning format.

This project was approved by the Medical College of Wisconsin Institutional Review Board (PRO00032826).

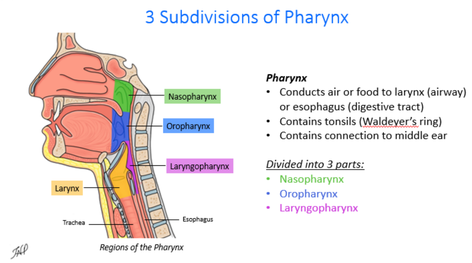
METHODS

LEARNING OUTCOMES:

1. Identify the three subdivisions of the pharynx and important features within each subdivision.
2. Identify muscles of the pharynx and describe their function and innervation.
3. Describe function, blood supply, innervation and lymphatic drainage of the pharynx.
4. Identify cartilages, ligaments, and muscles of the larynx and describe their functions.
5. Describe innervation, blood supply, and lymphatic drainage of the larynx.
6. Apply knowledge of pharynx and larynx anatomy to answer clinical questions.

Figure 1. Pre-Work Examples:

A **Example from Required Pre-Work Video (Still from Video)**



B **Example of Optional Pre-Work Activity (Labeling Worksheet)**

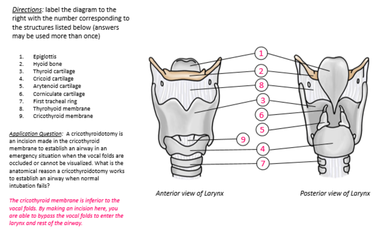
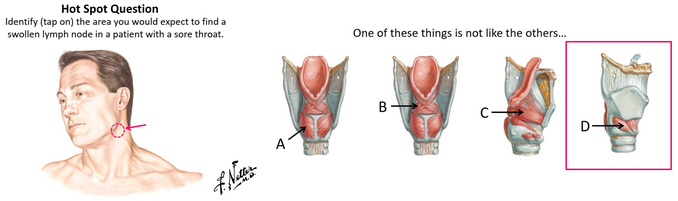
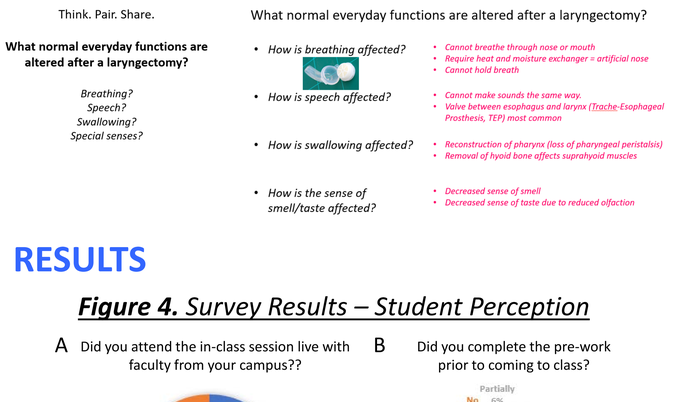


Figure 2. Problem Set Examples

A **In-Class Problem Set:** Early questions



B **In-Class Problem Set:** Late questions

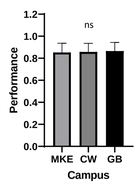


RESULTS

Figure 3. Exam Performance

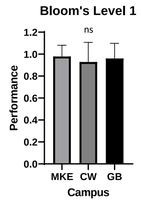
A **Head & Neck Exam**

Campus	Mean	St Dev
MKE	.853	.084
CW	.857	.079
GB	.866	.078



B **Low Level Blooms Taxonomy**

Campus	Mean	St Dev
MKE	.978	.102
CW	.929	.179
GB	.960	.138



C **High Level Blooms Taxonomy**

Campus	Mean	St Dev
MKE	.875	.180
CW	.867	.159
GB	.920	.153

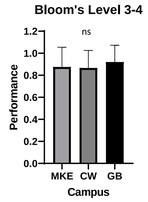


Figure 3. ***No significant difference in exam performance between campuses.***
(A) Aggregate performance on all Head and Neck exam questions. (B-C) Exam performance on Larynx and Pharynx exam questions at varying levels of difficulty (B) Performance on low level Bloom's Taxonomy questions (level 1). (C) Performance on high level Bloom's Taxonomy questions (level 3-4). ns = no significance by One-Way ANOVA with Tukey's post test

Figure 4. Survey Results – Student Perception

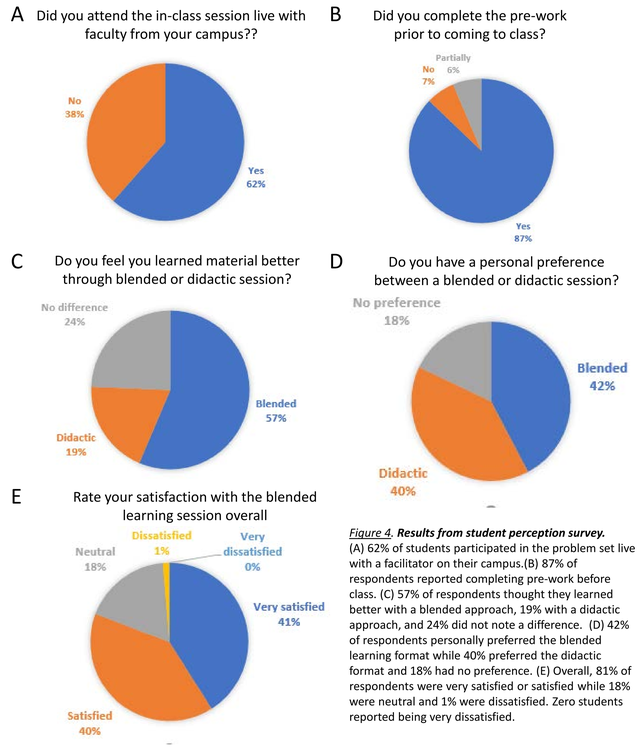


Figure 4. ***Results from student perception survey.***
(A) 62% of students participated in the problem set live with a facilitator on their campus.(B) 87% of respondents reported completing pre-work before class. (C) 57% of respondents thought they learned better with a blended approach, 19% with a didactic approach, and 24% did not note a difference. (D) 42% of respondents personally preferred the blended learning format while 40% preferred the didactic format and 18% had no preference. (E) Overall, 81% of respondents were very satisfied or satisfied while 18% were neutral and 1% were dissatisfied. Zero students reported being very dissatisfied.

RESULTS

Aggregate performance on Head and Neck questions overall and larynx and pharynx-specific questions was compared between campuses (**Figure 3**)**.** There was no significant difference in Head and Neck exam performance between campuses (**Figure 3A**). Likewise, there was no significant difference in performance between campuses on low (**Figure 3B**) or high (**Figure 3C**) Bloom's taxonomy level assessment questions. Together these data show equivalent comprehension among students on the topic of Larynx and Pharynx regardless of facilitator or site. Additionally, student performance on larynx and pharynx-specific questions was equivalent to overall exam performance showing the module effectively met session objectives.

Response to the follow-up survey was low, with 78/254 learners completing the survey (30.7% response rate). Results of the survey showed 48/78 survey respondents (62%) attended the in-class session live with a facilitator **(Figure 4A).** Note that in-class sessions on both sites were also recorded and available to watch at any time. 68/78 survey respondents (87%) completed the pre-work prior to the in-class session, while 5/78 partially completed it and 5/78 did not complete it (**Figure 4B**). Outside of the required materials, students reported using supplementary resources such as anatomy atlases, the Complete Anatomy program, and YouTube videos to learn more about the larynx and pharynx. When asked which format was better for their learning, 44/78 respondents (57%) said blended learning, while 18% thought they learned better through didactic lecture, and 33.3% reported no difference (**Figure 4C**). When asked about personal preference, 33/78 respondents (42%) preferred blended learning, while 40% preferred didactic and 18% reported no personal preference **(Figure 4D).**

Overall, 63/78 respondents (81%) were very satisfied or satisfied with the blended learning session, 14/78 (18%) were neutral, only 1/78 (1%) was dissatisfied or very dissatisfied (**Figure 4E**).

Representative comments from student survey:

"I find that I do better when I have access to the material before lecture (especially a video), because when I hear it for a second time, I spend less time trying to figure out what the words mean, and can start getting a handle on the concept itself."

"I like both blended learning and didactic. I think blended learning is a good way to switch things up a bit, especially for more difficult topics like the larynx where it helped to go over it multiple times. However, I don't want the majority of lecture to be presented in a blended model because it can add more to our 'to-do' lists on top of regular studying."

"Hard to change from all in person to blended learning without being used to it. Struggled with it but I can see the appeal to it in that you get additional exposure to the material and the ability to apply the material to situations. Separates the "chewing through material" and "using the material"."

"I think that because this particular area of the body was so difficult for me it made coming to the questions session kind of pointless because I needed the material taught in person. I think the blended style would've worked better for on a topic that was more easy to understand."

CONCLUSIONS & RECOMMENDATIONS

This study shows that **this blended learning module on larynx and pharynx gross anatomy resulted in high levels of learner comprehension and satisfaction**. Additionally, it demonstrates a viable blended learning approach for instruction across multi-site institutions by having all students complete engaging pre-work before participating in a problem set with a on-site instructors.

Author Recommendations for Successful Blended Learning Session:

- Interactive pre-work (active & engaging)
- Pre-work required to attend session
- *Trust* with in-class facilitator and classmates
- In-class material worth attending class (targeted and clinically relevant)

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