



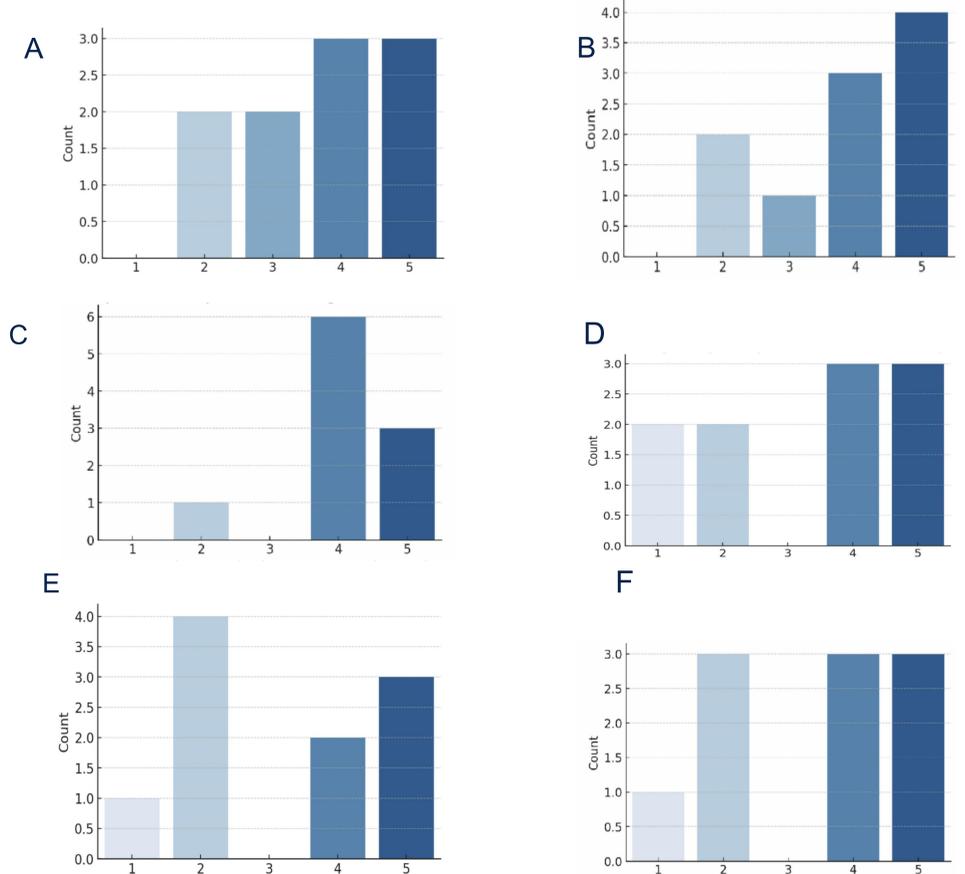
## Introduction

- Recent developments in three-dimensional (3D) digital modeling now provides hyper-realistic anatomical representations, with promising applications for medical education.
- Despite the potential of virtual 3D modeling platforms, technology to integrate them into education remain underdeveloped. Developing an integrated interactive assessment tool could enhance the efficacy of 3D models in surgical education.
- In this pilot feasibility study, we aimed to develop and implement a web-based platform integrated with our online Virtual Reality Skull Base Laboratory for self directed learning with 3D models and integrated automated quizzes. User perception is assessed.

## Materials and Methods

- 3D cadaveric models annotated with anatomic landmarks were generated and uploaded onto a platform linked to our departmental website.
- We designed software to register subjects, dynamically generate multiple-choice quiz questions, prompting learners to identify the relevant anatomical locations and record responses in a database.
- The quiz engine, implemented in JavaScript, securely logs user responses for performance and feedback tracking.
- Feedback tracking:** Medical students and residents (n=10) were recruited to assess user experience. They interacted free form with the models for 3-5 minutes, then entered the mode quiz for 3 to 5 models. A post intervention survey was administered rated on a Likert scale. Data was analyzed descriptively.

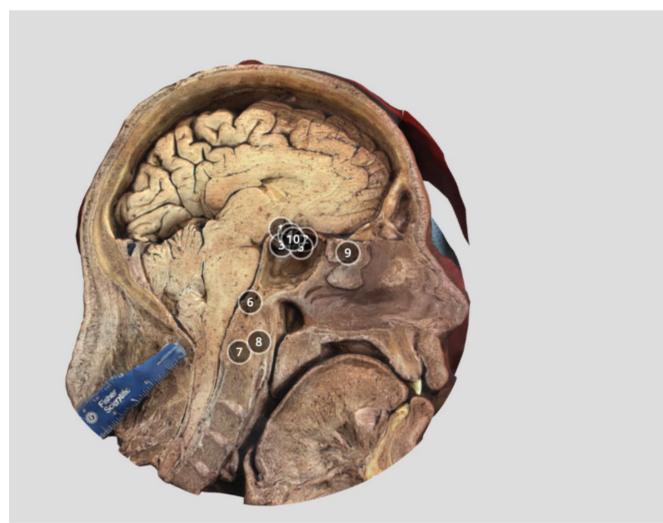
## Results



**Figure 1. Student survey results assessing six usability items.** Using Likert-scale (1 = strongly disagree, 5 = strongly agree), we demonstrate the distribution of responses for: (A) Interest in using 3D models to study anatomy; (B) Perceived future usefulness of interactive 3D models in medical education; (C) Helpfulness for learning anatomical names and locations; (D) Helpfulness for understanding 3D anatomical relationships; (E) Enjoyment using the platform; and (F) Ease of integrating the quiz with the model. N=10 medical students with 100% study completion and survey responses.

## Results

- The quiz engine successfully generated quizzes for 11 models with 10-20 annotations per model.
- The six usability items demonstrated excellent internal consistency, with a Cronbach's alpha of 0.93
- Users successfully interacted in "study mode" (i.e. annotations label the anatomic structure as it is rotated or enlarged) or in "quiz mode" (i.e. annotation labels are hidden and a multiple-choice question test is generated).
- The platform accurately scored the quizzes and successfully transferred user performance data and feedback responses to an independent database.
- All users successfully navigated the platform and completed the quizzes. 90% of students found the platform helpful for learning anatomic names/locations, while only 60% found it easy to use.
- There was a trend towards students with prior anatomy knowledge reporting higher usability scores than students without, however this was not statistically significant (p=.68).



### Q1: Where is Pituitary gland?

- Annotation 5
- Annotation 4
- Annotation 3
- Annotation 8
- Annotation 2

Submit Answer

### Q2: Where is Middle turbinate?

- Annotation 9
- Annotation 2

Show Model Annotations

Return to Home

Logout



**Figure 2. Sample screenshot of 3D VR model with integrated quiz interface.**  
<https://ohns.ucsf.edu/sinus/virtual-reality-anatomic-lab>

## Results

Survey Questions	Likert score (Mean ± SD)
"I found the 3D models an interesting method to study anatomy."	3.70 ± 1.16
"I think integrating interactive 3D models into medical education will be useful in the future."	3.90 ± 1.20
"I found the 3D model platform helpful for learning names and locations of anatomy."	4.10 ± 0.88
"I found this platform helpful for understanding 3D anatomical relationships."	3.40 ± 1.51
"I enjoyed using this platform to study anatomy."	3.20 ± 1.55
"I found integrating the quiz with the model easy to use."	3.30 ± 1.64

**Table 1. Descriptive statistics for six Likert-scale usability items as graphed in Figure 1** (1 = strongly disagree, 5 = strongly agree). Data shown as mean ± SD.

## Conclusions and Future Directions

- This feasibility pilot study demonstrates the development and successful implementation of an online surgical education platform using 3D cadaveric models with integrated quizzes and performance analysis.
- User feedback allows future optimization. The platform concept was overall favorably perceived by trainees, but issues with the VR platform were identified. Future work will focus on refining the user interface.
- Preparing high quality web based anatomic educational tools has potential to improve access to health education and decrease healthcare inequity by lowering the hurdles to teaching complex anatomy for medical education. Future research is needed to evaluate cross-cultural usability, particularly in resource-scare areas.