Evidence-Based Practice: Implications of a Guided Activity for the Skull Base

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POSTER ABSTRACT #122

INTRODUCTION

- Cranial nerves are high yield on NBOME level 1 and USMLE Step 1 exams.
- Spatial relationships and detailed knowledge of structure/function are required to apply knowledge to clinical scenarios.
- Traditional teaching methods include 2D diagrams, didactics, or a model skull with a single wire and encourage rote memorization.
- Active learning can improve student engagement and interest[1]. No known studies apply active learning methods to supportive structures at the skull base.
- The current study designed an active learning activity to aid visualization of spatial relationships and engagement with the learning content.
- The activity was then compared with two traditional methods during a learning session.

Objectives & Hypotheses

Objectives:
- Determine which of 3 learning tools results in the highest student test scores
- Assess student perceptions and cognitive load of each resource

Hypotheses:
- $H1_A$: The guided activity group will score higher on the post-test compared with the single wire skull lab and lecture groups.
- $H2_A$: Students will have more positive perceptions for the guided activity compared with the single wire skull lab and lecture.
- $H3_A$: Students will perceive the guided activity as having lower cognitive load compared with the two traditional learning tools.

METHODS

Guided Activity Design

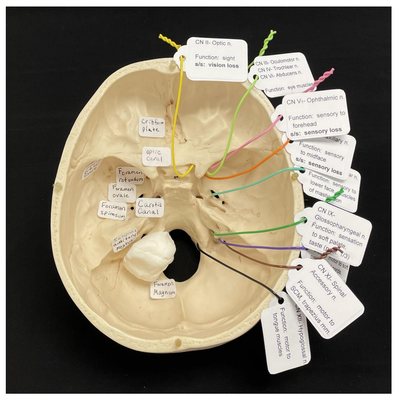


Figure 1. Guided learning activity completed by a MS1 student

TASKS:
- Left side: label foramina
- Right side: pass a colored wire through the opening where each cranial nerve exits the skull
- Match the nerve with pre-made structure/function tags
- Simulate lesions in different locations using air-dry clay. Use the tags to predict patient signs/symptoms.

Study Design

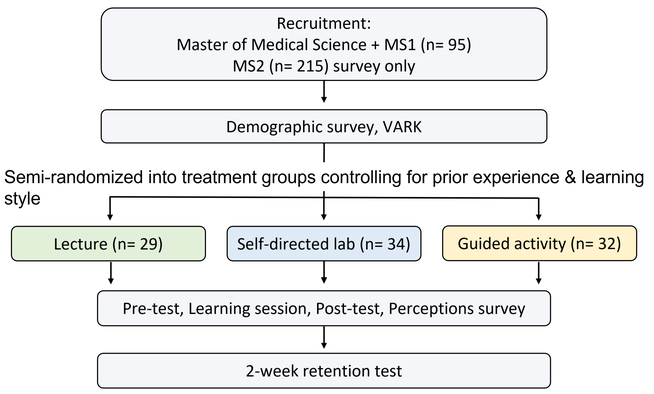
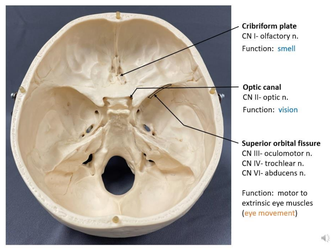


Figure 2. Flowchart demonstrating methodology of the study.

Learning Session

3 TREATMENT GROUPS

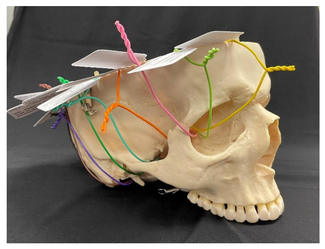
2 traditional methods (controls)



Lecture

Skull with single wire

1 novel learning method



Guided activity

Figure 3. Comparison of the three treatment groups

Each group had a unique learning tool:
- **Lecture**: PowerPoint with audio overlay
- **Single wire**: used to point to structures and pass through openings
- **Guided activity**: craft supplies and instructions for their use

- Students had 30 minutes to view the introductory PowerPoint and work with a skull model (if assigned)
- PowerPoint content and type of skull were identical for all 3 groups

Figure 4. MS1 students participating in the guided activity

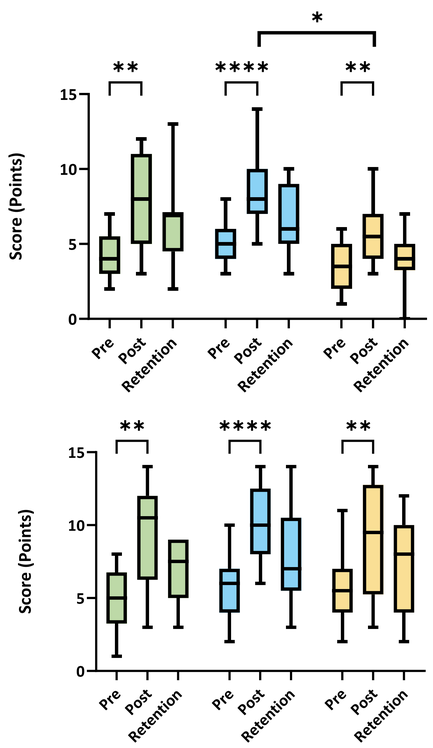
Assessment Instruments

Pre/Post/4-week retention tests
- 15 multiple choice questions: structure, function, clinical applications

Qualitative Survey
- 7 perceptions questions, 7 cognitive load questions[2]
- 5-point Likert-scale

RESULTS

Pre, Post, and Retention Tests



Novice: Single wire skull lab scored higher on post-test than guided activity

Advanced beginner: No difference between groups

All treatment groups increased knowledge from pre-test to post-test

Figure 5. Comparison of test scores for novice students and those with pre-medical school exposure to the content. Whiskers: 10-90%.

Perceptions

All experience levels: guided activity perceived more positively than both traditional tools

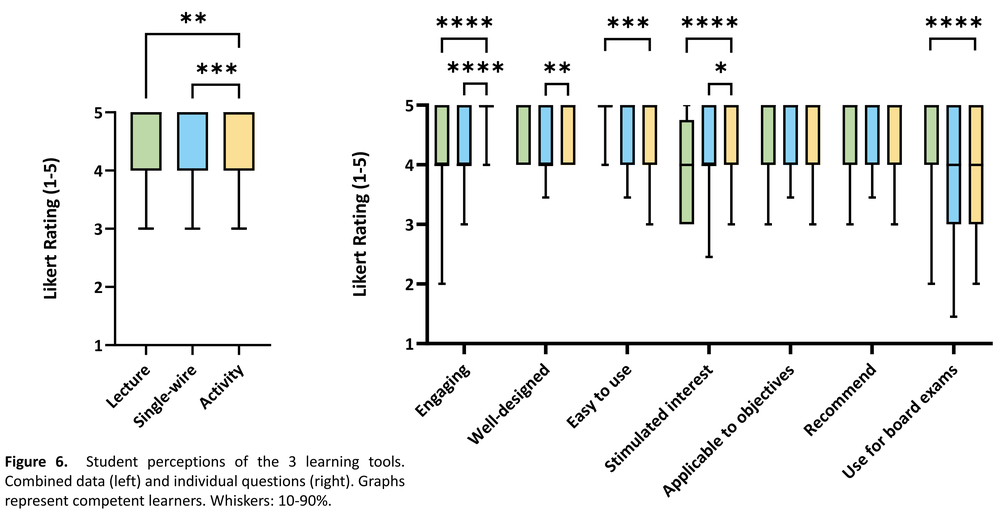


Figure 6. Student perceptions of the 3 learning tools. Combined data (left) and individual questions (right). Graphs represent competent learners. Whiskers: 10-90%.

Cognitive Load

Novice and Advanced Beginner: guided activity perceived to have less complex content than lecture

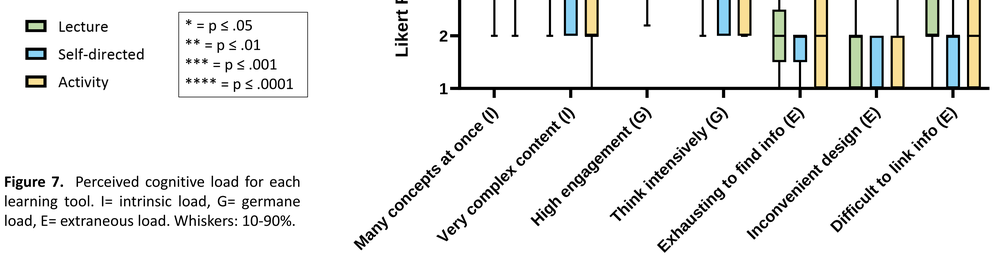


Figure 7. Perceived cognitive load for each learning tool. I= intrinsic load, G= germane load, E= extraneous load. Whiskers: 10-90%.

DISCUSSION

- Novice students scored highest on the post-test using the self-directed skull lab
- All groups had more positive perceptions of the guided activity compared with traditional learning tools
- Novice and advanced beginner students found the guided activity engaging and interesting. Competent learners additionally reported that the guided activity was well designed, easy to use, and useful for studying for board exams.
- Novice and advanced beginner students perceived the guided activity as having less complex content.

CONCLUSION
- The single wire skull lab is recommended to improve test scores in novice students
- The guided activity is recommended to increase engagement in students with prior exposure to the learning content
- Cognitive load data suggest a benefit to using the guided activity. This is a promising area for future research.

SIGNIFICANCE

- The most effective and preferred learning resource differed based on prior exposure to the learning content.
- This study highlights the importance of testing educational tools with different levels of preclinical learners to tailor resources to student needs.
- The current study is the first known to develop an active learning exercise for neurovascular structures of the skull base

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The authors are grateful to the following organizations for their support:
- American Association of Colleges of Osteopathic Medicine- 2022 Research Grant (BL, MT, RK)
- LECOM Consortium for Academic Excellence (LCAE)- 2022 Research Grant (BL, RK)