

# To integrate or not to integrate?

Abstract A study of the educational efficacy of an integrated embryology and gross anatomy online resource for dental students

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Hailey L Bunker, BS<sup>1</sup> | Jennifer M Stratford, MS, PhD<sup>2</sup> | Marissa N Hight, BA<sup>1</sup> | Caley M Orr, PhD<sup>1,3,4</sup> | Lisa MJ Lee, PhD<sup>1,3</sup>

1. Modern Human Anatomy Program University of Colorado Anschutz Medical Campus  
2. Department of Psychology and Neuroscience, University of Colorado Boulder  
3. Department of Cell and Developmental Biology, School of Medicine University of Colorado Anschutz Medical Campus  
4. Department of Anthropology, University of Colorado Denver



Modern Human Anatomy Program  
UNIVERSITY OF COLORADO  
ANSCHUTZ MEDICAL CAMPUS

## Background & Rationale

- Many Health professional programs now offer integrated curriculum and increasingly rely on asynchronous online resources
- Most online resources are subject specific
- There are few studies reporting the educational efficacy of integrated content presentation compared to stand alone content in a digital resource

**Research Question: Does integration of embryology in an anatomy of the cranial nerve digital tutorial lead to better learning outcome than a stand-alone anatomy tutorial in dental students?**

## Materials & Methods

### Digital Resources

Two digital tutorials were created on cranial nerve anatomy; Both contained the identical anatomy content, but the experimental tutorial included the additional embryology content relevant to cranial nerve anatomy (Figure 1)

Figure 1.

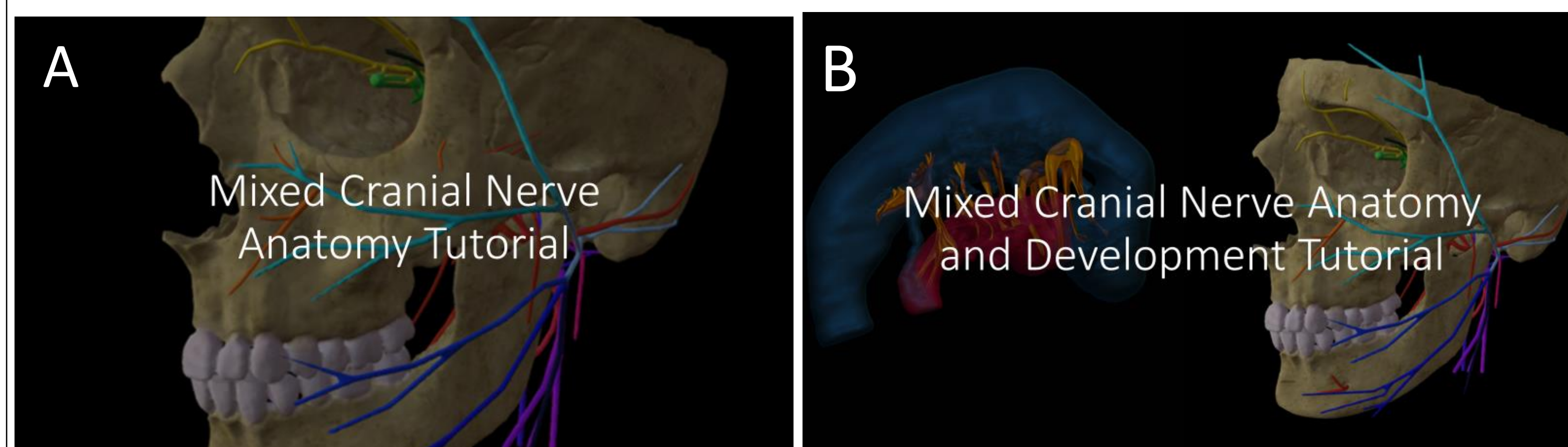


Figure 1. The tutorial sample title slide for the A) control resource containing only anatomy content and the B) experimental resource containing both anatomy and embryology content (Cranial Nerve image Source: <https://sketchfab.com/3d-models/cranial-nerves-9a8f0081425c4fb2b3fb93393de1cd16>)

### Study Design

- Randomized single-blind study was conducted with the 1<sup>st</sup> and 2<sup>nd</sup> year dental students (Figure 2)

Figure 2.

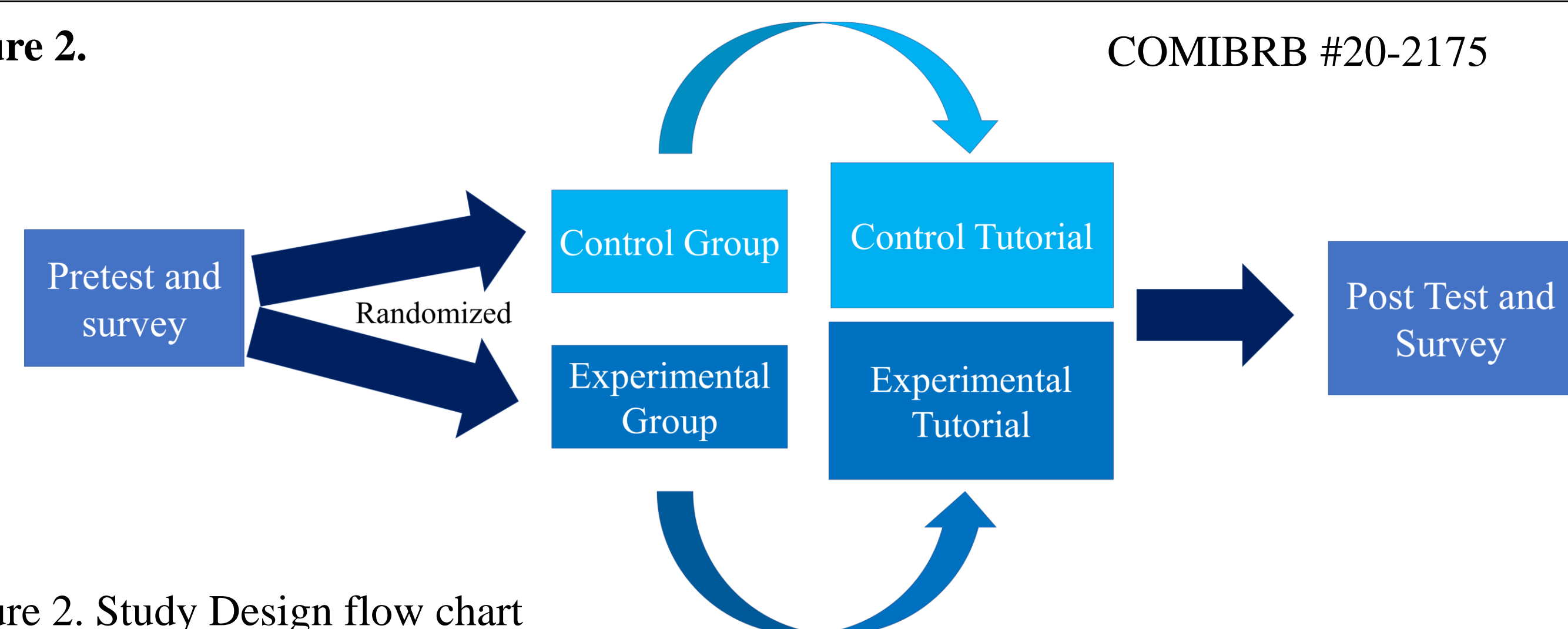


Figure 2. Study Design flow chart

### Data Analyses

- Anova and Tukey Honest Significant Difference (HSD) tests were used to analyze quantitative quiz and survey data
- Thematic analyses was performed to identify common themes in the open comments

## Results

### Learning Outcomes

- All study participant groups significantly improved the post test scores (Figure 3) (Anova (F (2, 161) = 3.20, p < 0.05, partial h<sup>2</sup> = 0.03))
- There was no significant difference in the post test improvement between the experimental and the control groups (Figure 3) (interaction: F(2, 157) = 2.79, p = 0.06)
- The post test improvement was significantly higher in the 1<sup>st</sup> year Dental students (D1) compared to the 2<sup>nd</sup> year Dental students (D2) (Figure 4) (main cohort effect: F(1,2) = 4.88, p < 0.05, partial h<sup>2</sup> = 0.06, Tukey HSD, p < 0.05)

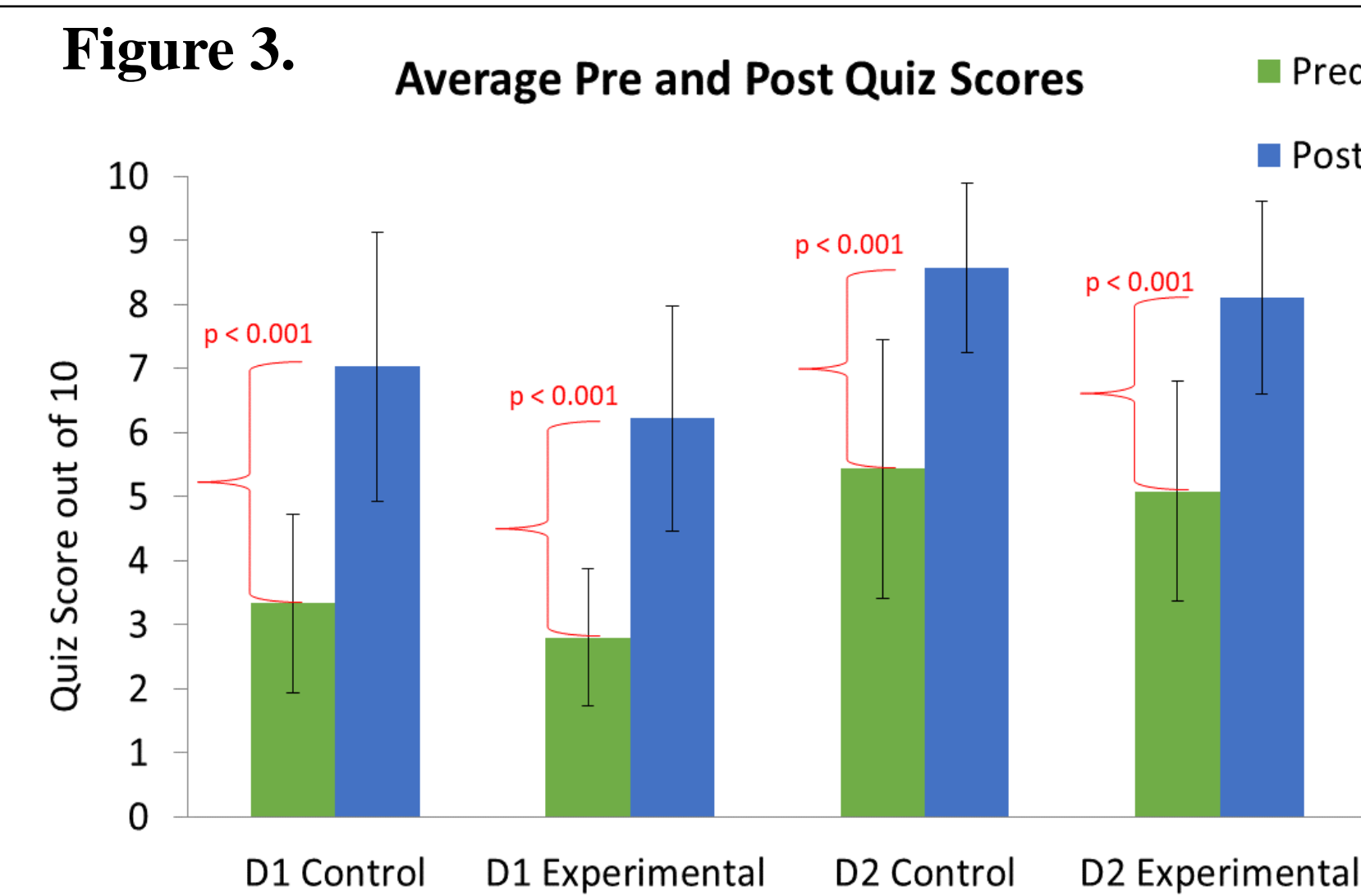


Figure 3: The post test scores were higher than the pre the control and experimental groups had the same improvements

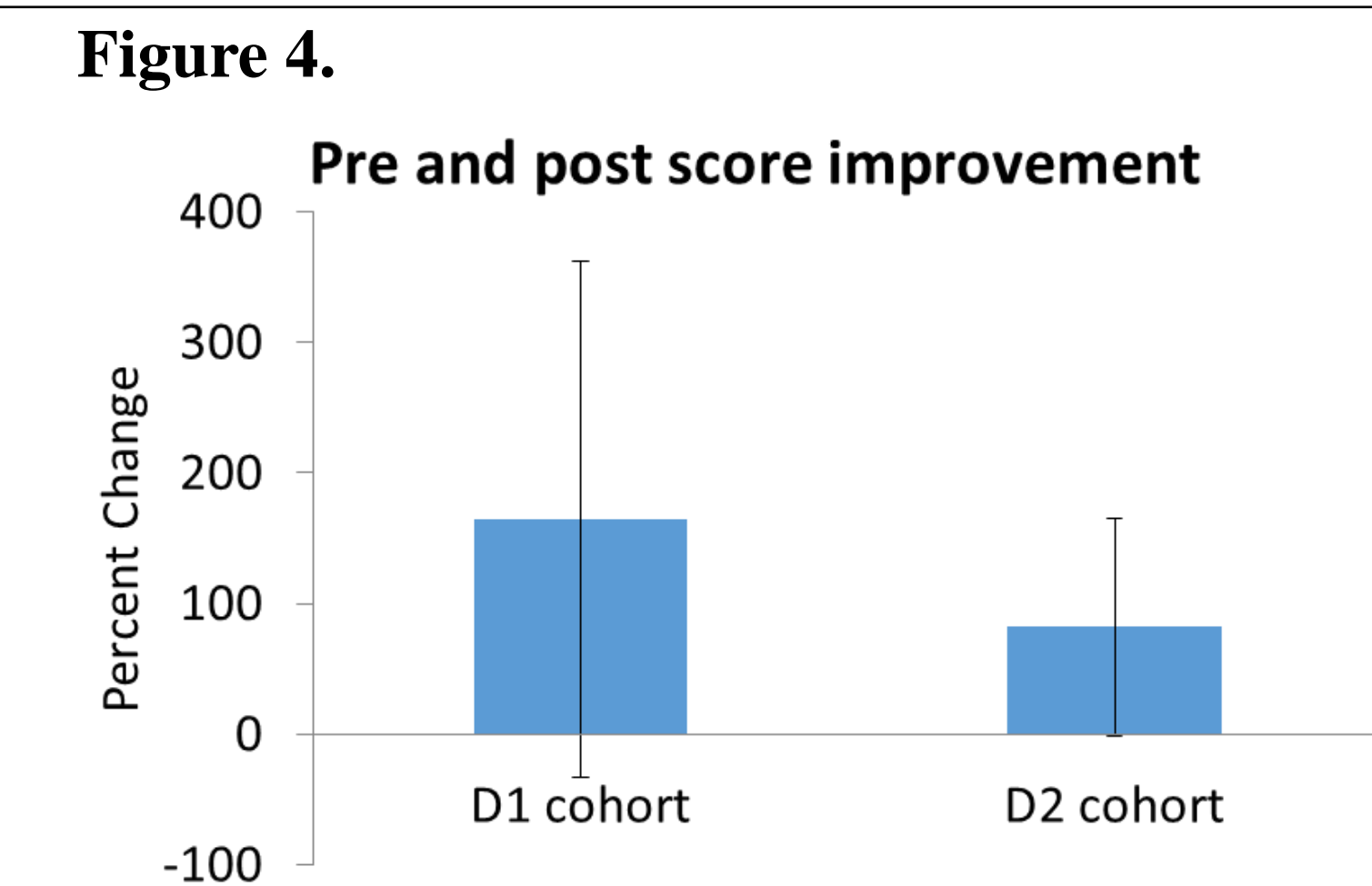


Figure 4: The change from pre to post test scores were higher in the D1 cohort than the D2 cohort

### Survey Results

- Students perceived that they had learned from the tutorials. (Figure 4)
- D1's perception of their learning was significantly higher than the D2 ratings (Tukey HSD, p < 0.05) (Figure 4)
- Self reported confidence level in cranial nerve anatomy after viewing the tutorial increased significantly in all cohorts. ANOVA, F(1, 139) = 159.53, partial h<sup>2</sup> = 0.54. (Figure 5)
- No other significant differences in quantitative survey responses were noted. Main effect group: F(1, 2) = 0.22, p = 0.64)

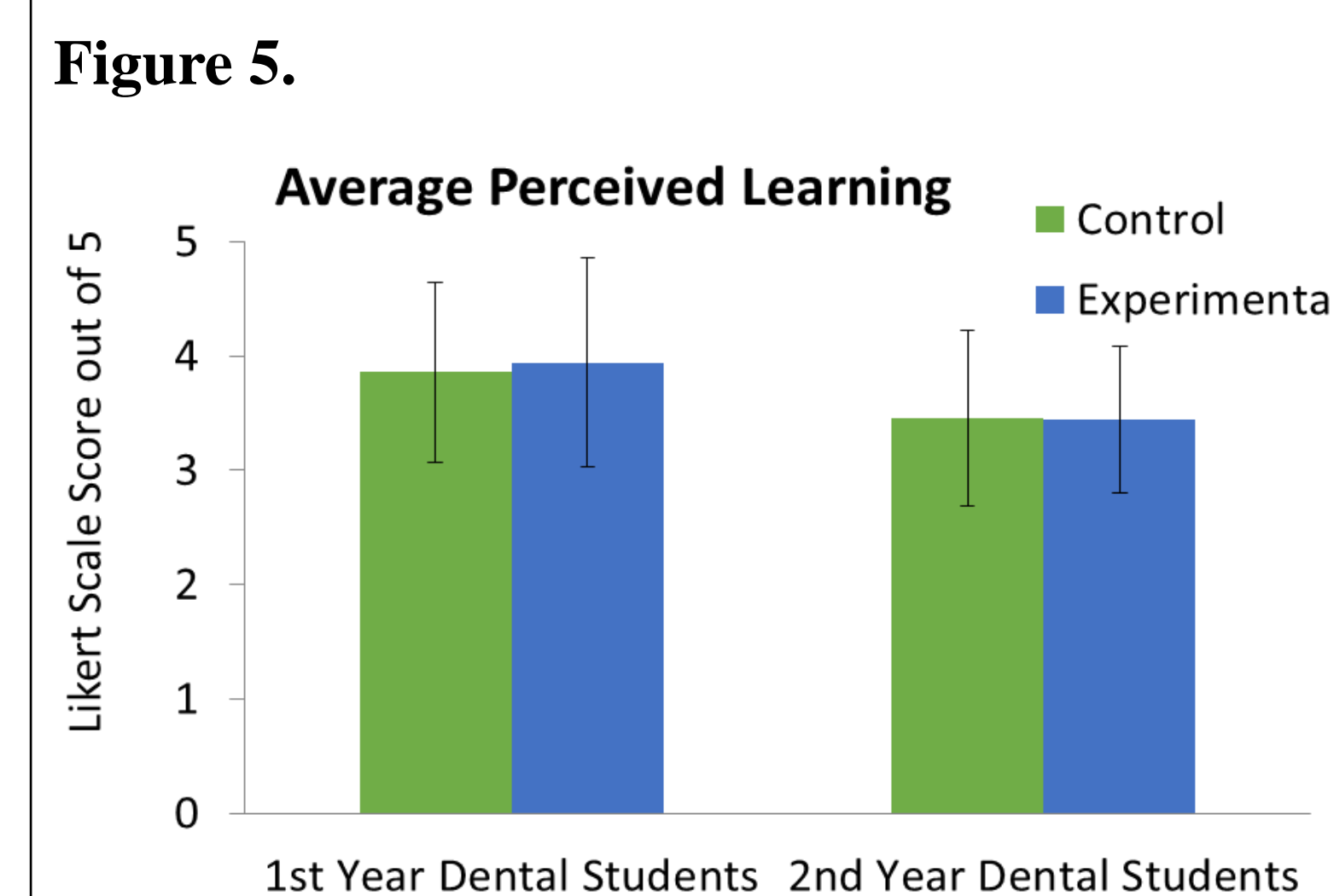


Figure 4: Students' self report on the amount of learning from the assigned tutorial

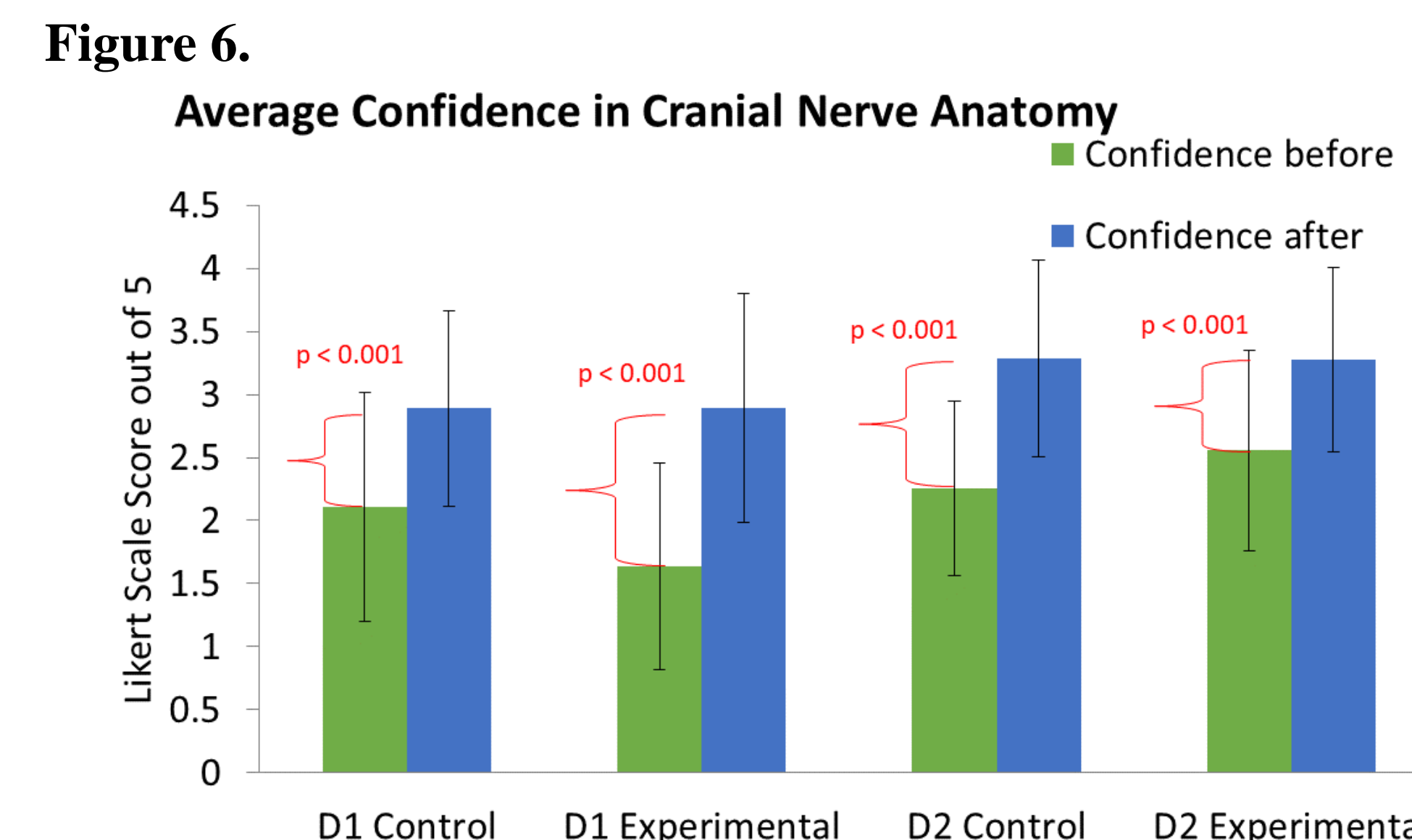


Figure 5: Students' self report on confidence in cranial nerve anatomy before and after assigned tutorial. No Significant difference in % change of confidence between control and experimental groups

## Results Cont'd

### Thematic analysis

- Common themes across all cohorts were the visual appeal and the video format being beneficial for learning
- Unique theme from the experimental groups was the contextual benefit of embryology content in learning the anatomy
- The 1<sup>st</sup> year dental students also felt more overwhelmed by the content of the video compared to the 2<sup>nd</sup> year dental students (Figure 7)

Figure 7.

### 1<sup>st</sup> year Dental Student Comments

“Having never had anatomy it seemed like a lot of info regarding muscles and embryonic development in a way distracted from learning the nerves themselves”

“It was nice being able to see how the embryonic development determined where the nerves ended up”

### 2<sup>nd</sup> year Dental Student Comments

“...it was really helpful to see the embryologic development and how it contributes what the different nerves innervate”

“I appreciate the concise delivery and 3D model presentation”

Figure 7: Students' comments on strength of the video and areas the video could be improved

## Conclusions and Discussion

- The integrated content had no effect on student learning contrary to expectations
- The 1<sup>st</sup> year dental students' quiz scores improved more than the 2<sup>nd</sup> year students on quiz scores as well as perception of learning
- Studies such as this could contribute to more conclusive results with more time, study participants, and broader material
- This study demonstrates that integrated content does not harm student learning
- There are effective ways of teaching anatomy through online resources, and this can be utilized to study effects of integrated content

## References & Acknowledgements

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