

**Can color-coding guide
the way through
complicated anatomy
figures?**

**IPHY SEI, Janie Routh &
Human Anatomy Working
Group (Ruth Heisler, Leif Saul,
& Christopher Lowry)**

Purpose

- To determine how cognitive load effects learning
- To develop way to manage cognitive load to maximize learning in the classroom

Background

- Three types of cognitive load
 - Extraneous Load (extra information)
 - Intrinsic Load (essential information)
 - Germane Load (relevant information)

Hypothesis

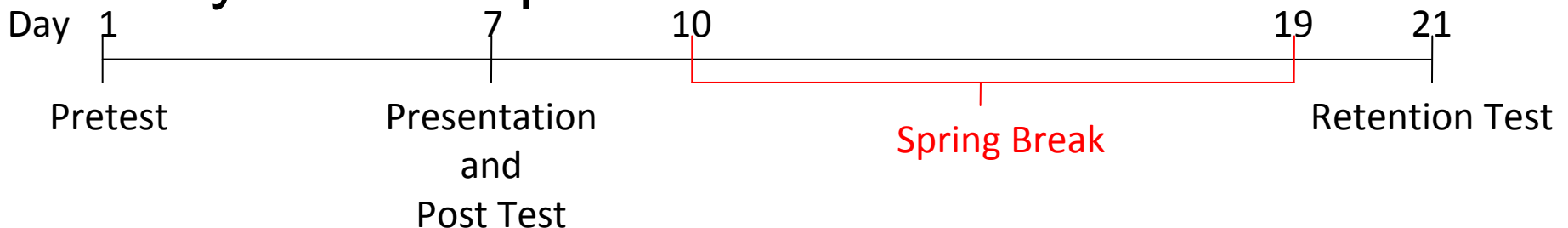
- If cognitive load is reduced in an image when presented to students, then the students learning will increase.

Prediction

- The color-cued group will demonstrate higher results on intermediate and retention tests, followed by the control group and then the isolated group

Methods

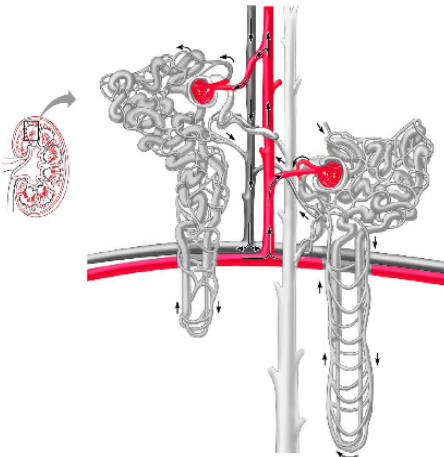
- Research subjects are divided into 3 groups and presented material based on their grouping
- Day 1: Complete a pretest
- Day 7: Attend a lecture with figures presented in 3 possible ways
 - Immediately after lecture a post test was administered
- Day 21: Complete a retention test





- Control Group (CNLT)

- Lecture uses the same image
- Does not highlight any structure at any point
- Lecturer points to appropriate structures while presenting
- Considered extraneous load or high intrinsic load



- Color Cued Group (CC)

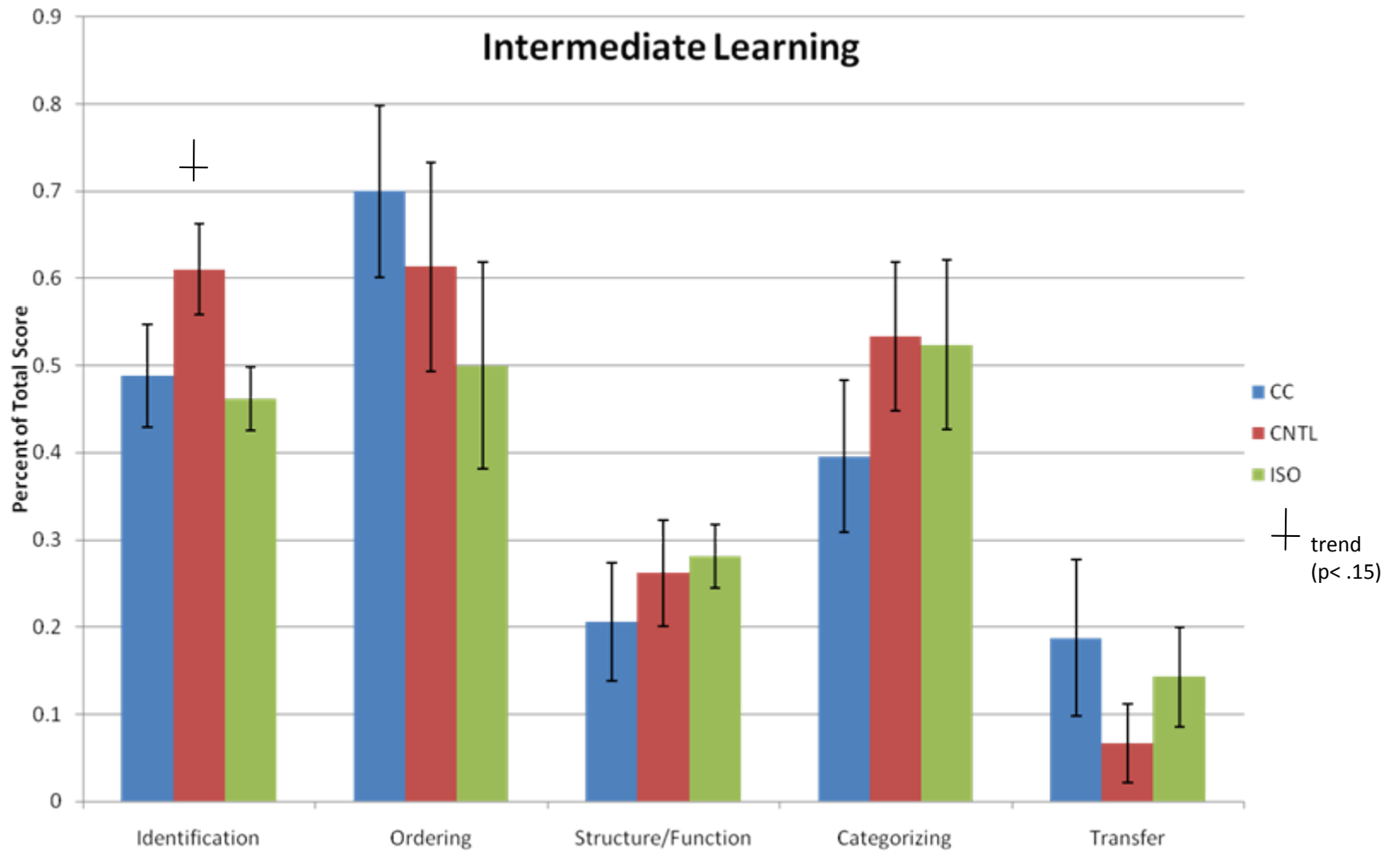
- Specific structures are highlighted when presented
- The whole structure remains during the presentation
- Color cueing is a way to manage high intrinsic load
- Grayed area is considered germane load



- Isolated Group (ISO)

- Specific structures are isolated when presented
- The whole structure is not shown during the presentation
- Results will help us differentiate how extraneous and germane loads affect learning

Intermediate Learning



ANOVA	F	P Value
Identification	2.369	0.106
Ordering	0.799	0.456
Structure/Function	0.457	0.637
Categorizing	0.76	0.474
Transfer	0.815	0.45



ANOVA	F	P Value
Identification	2.316	0.111
Ordering	0.21	0.811
Structure/ Function	1.984	0.15
Categorizing	1.252	0.296
Transfer	0.507	0.606

Summary

- The data did not represent significant differences in the intermediate and retention tests
- Trends ($p < 0.15$) did occur within the intermediate identification, retention identification, and retention structure/function
 - A larger sample size could have been significant

Conclusion

- Managing cognitive load may have increased retention for students in the color cued group?
- In the isolated group retention scores for identification questions and structure/function questions may have been the lowest so the context of the picture was germane?

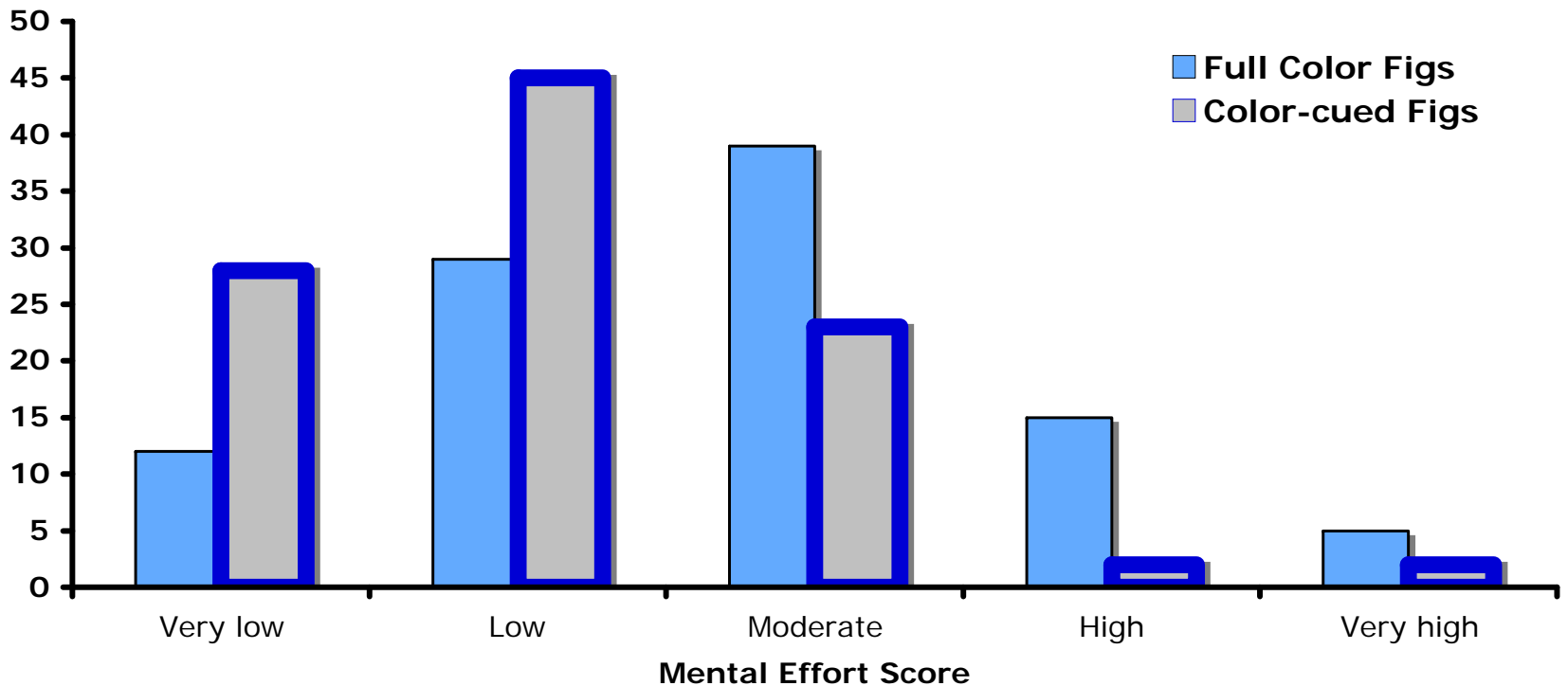
To be continued...

- We have not finished statistical interpretation of the data and the results are subject to change
- It is possible that we will continue the research by adding more subjects in hopes of reaching significance in the three groups that demonstrated trends

Moving the cognitive load study into the classroom.

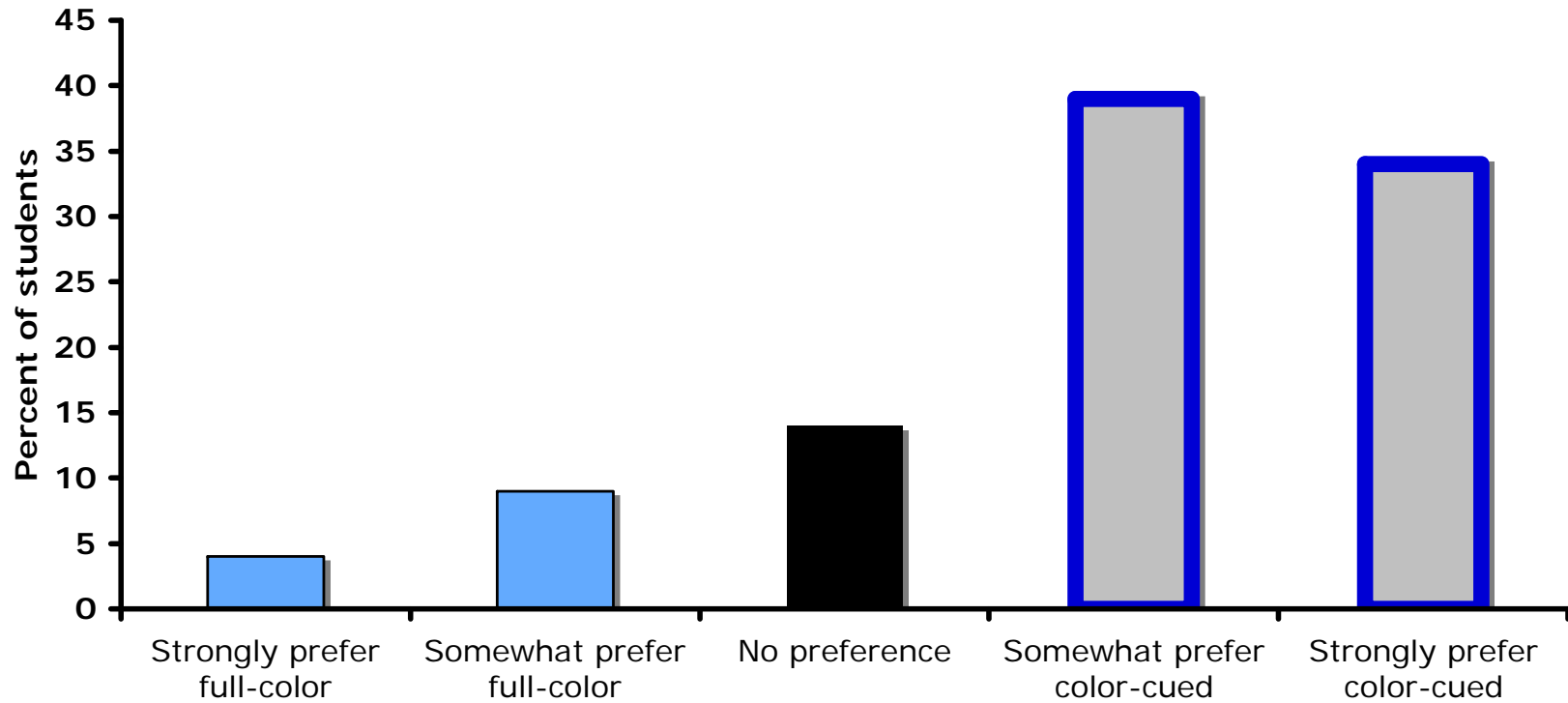
- Chose 5 pairs of figures (one full color control and one color-cued) per lecture topic in last 5 lectures of year. (Order of presentation randomized.)
- Each figure had two learning-goal related clicker questions associated with the figure.
- Clicker questions were asked at the beginning of the lecture (no answers revealed) and again after the end of the figure presentation.
- Questions similar to clicker questions were on final exam.

In class, students found color-cued figures to require significantly less mental effort to follow.



Pearson Chi-Sq = 48.9, $p < 0.001$

In class, students preferred the color-cued figures.



There was no difference in either (a) the average learning gain on in-class clicker questions related to the figures or (b) similar exam questions as clicker questions.

