Use of Supplemental Spaced Digital Image Identification Improves Student Performance on Medical Neuroanatomy Digital Practical Exams

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9th Annual Medical Education Day

Collaborative Team Members

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Lab Based Coursework

Lab Based Coursework in Medical School

- Gold Standard for Gross Anatomy Courses
- Consists predominantly of dissection and structural identification
- Requires a team approach
- Integrates material taught in the classroom to real life application
- Assessed primarily via practical exams

Challenges

- Need to be physically present in lab
- Lack of verification during self study
- Practical exams are associated with increased student stress
- Growing shortage of professors in the anatomical sciences
- Significant numbers of medical students fail to pass these courses each year

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Can the use of digital image identification, delivered in a spaced repetition model, enhance student understanding and performance on medical neuroscience practical assessments?

Methods – The Course

M1 Medical Neuroscience – BSOM

- 11 Labs distributed over four 36 question digital practical exams
- Each lab has an associated structure identification list indicating which structures students are expected to know for examinations

Considerations in Design

- How can we determine whether students using the resource are normally distributed?

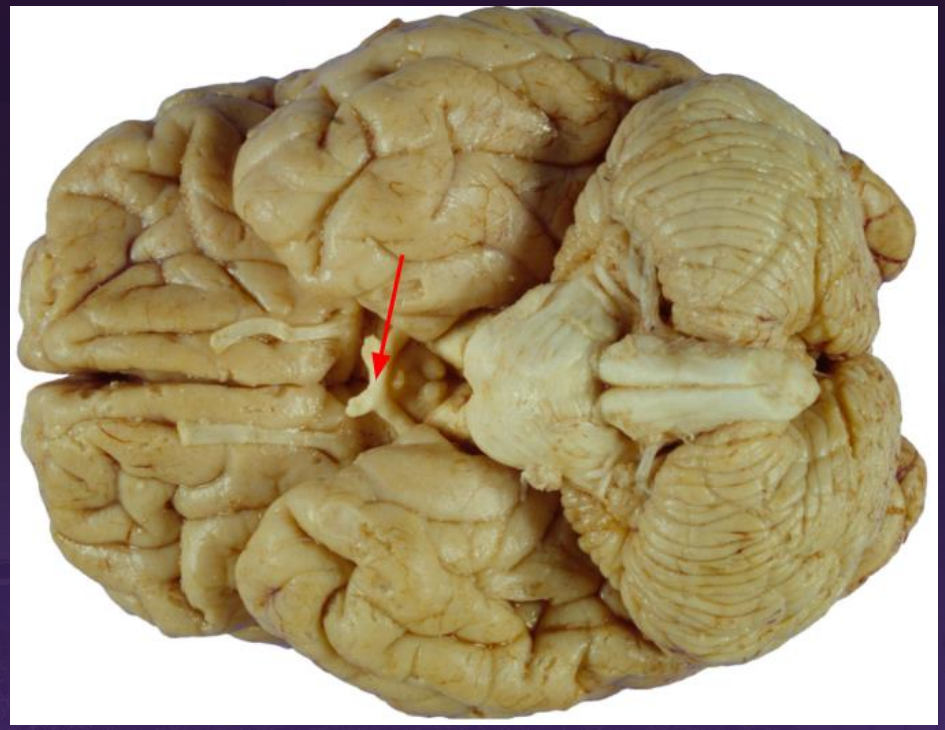
Methods – Resource Deck Creation

Identify Testable Structures for Each Exam

Randomly Select 30-35 Structures per Exam

Create Digital Flashcard (via Anki) Including Image and Structure Description

Evaluate Student Performance on Practical Exams



Optic Chiasm: X-shaped structure demarcating the crossing over of each optic nerve.
Crossing fibers from the medial retinal fields (lateral visual fields)

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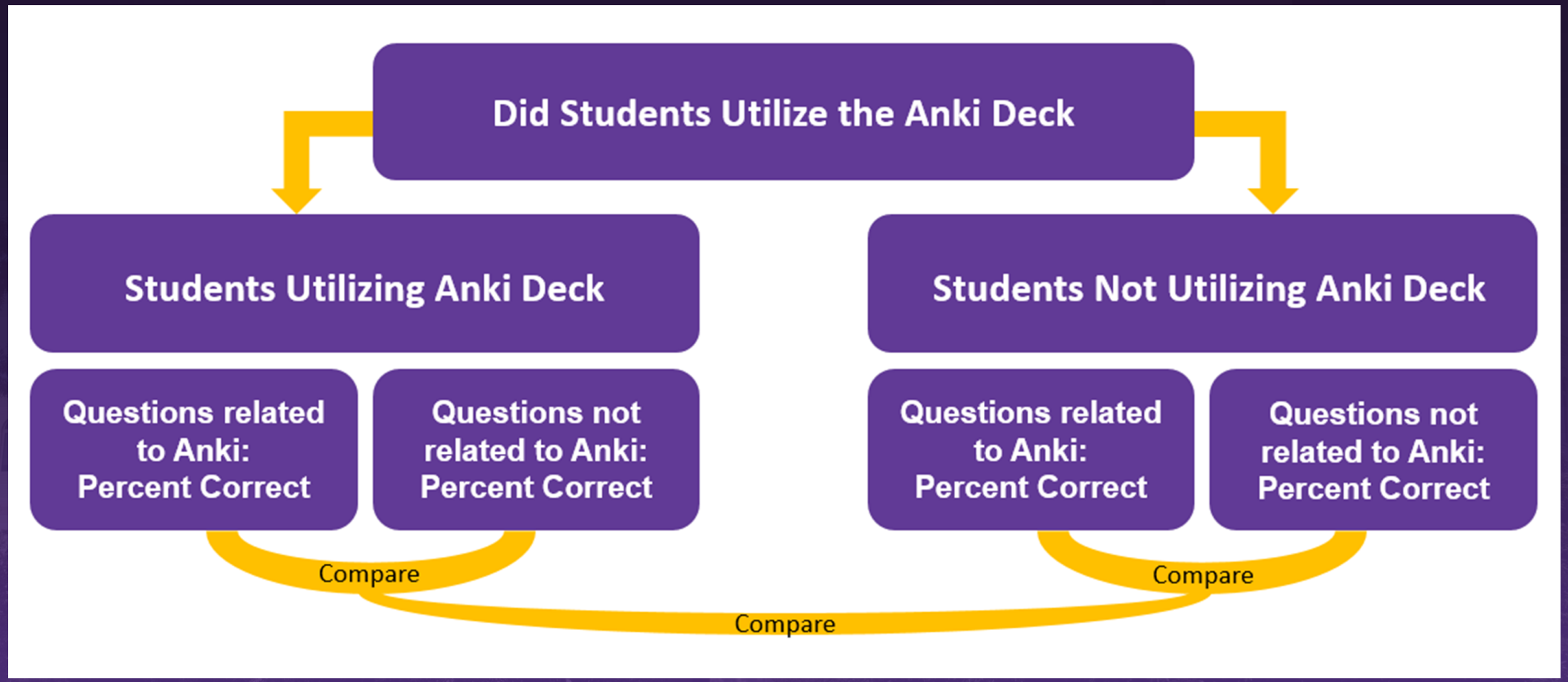
Methods - Analysis



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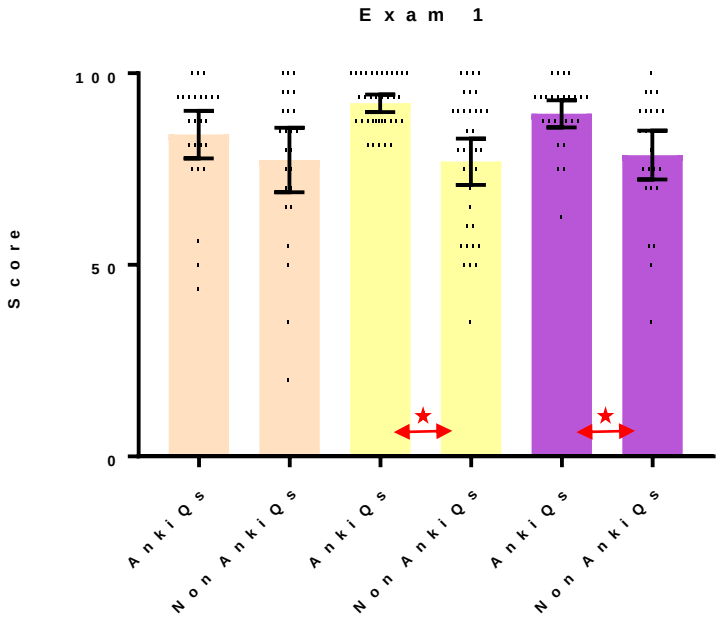
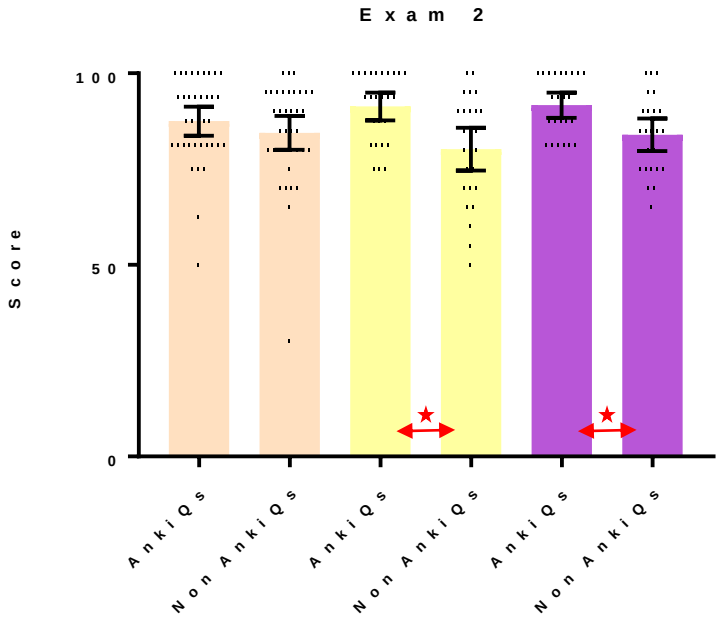
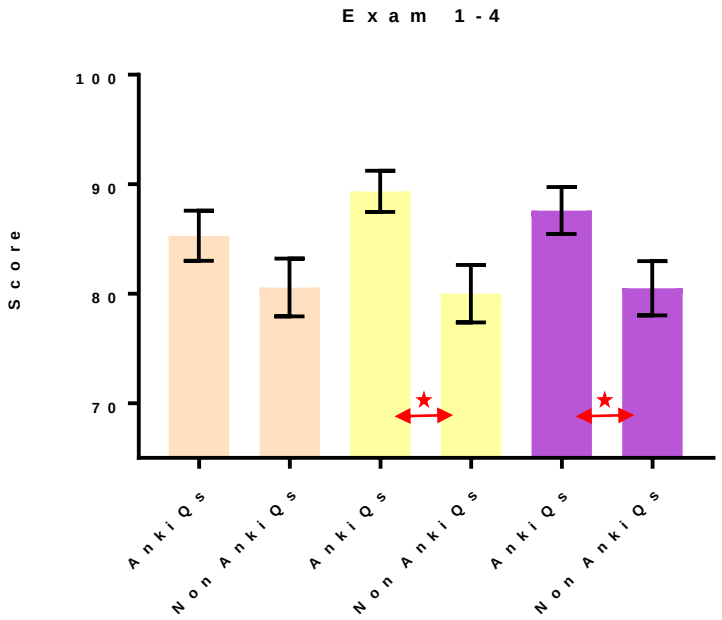
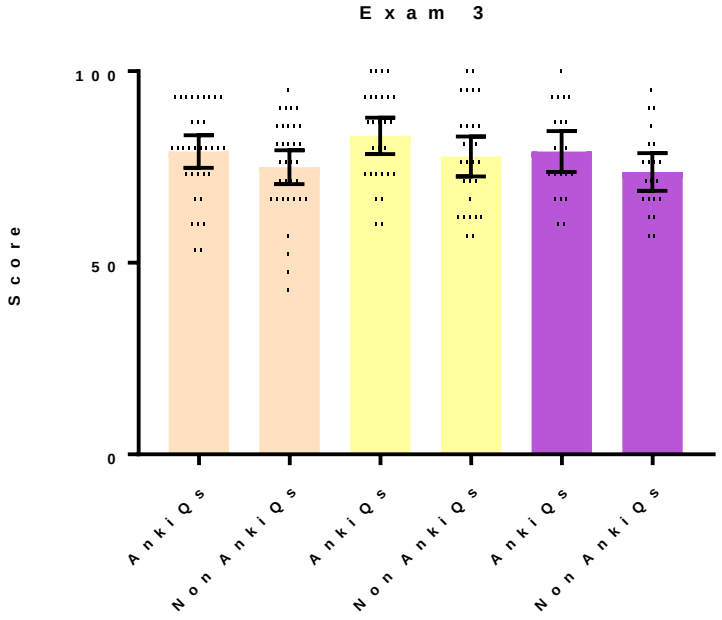
RESULTS

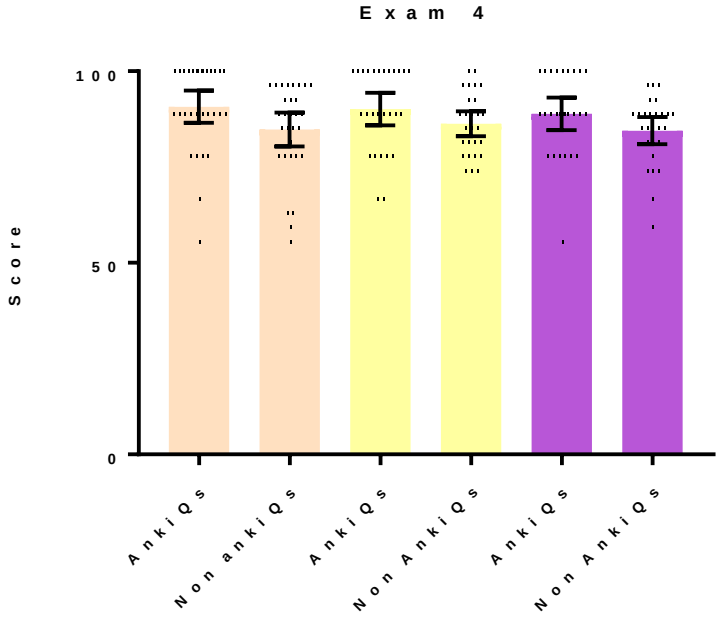
Student Scores on Anki vs Non-Anki Questions









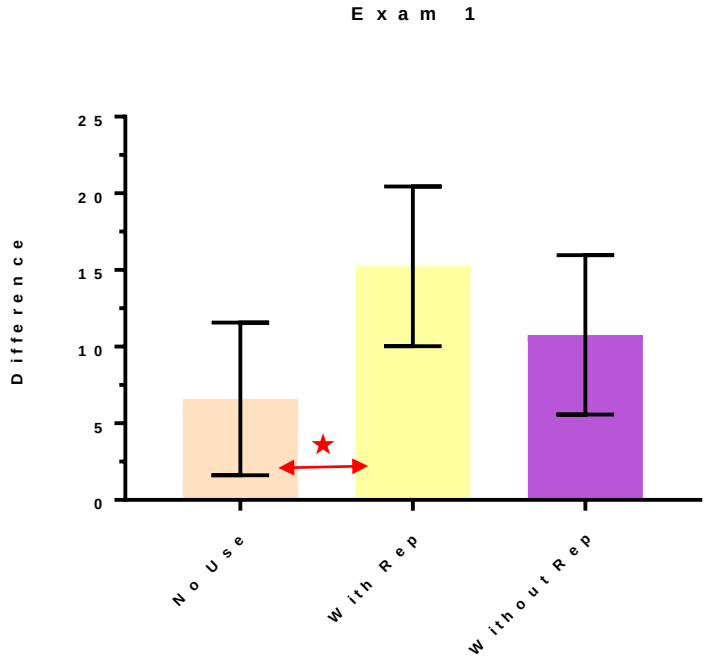


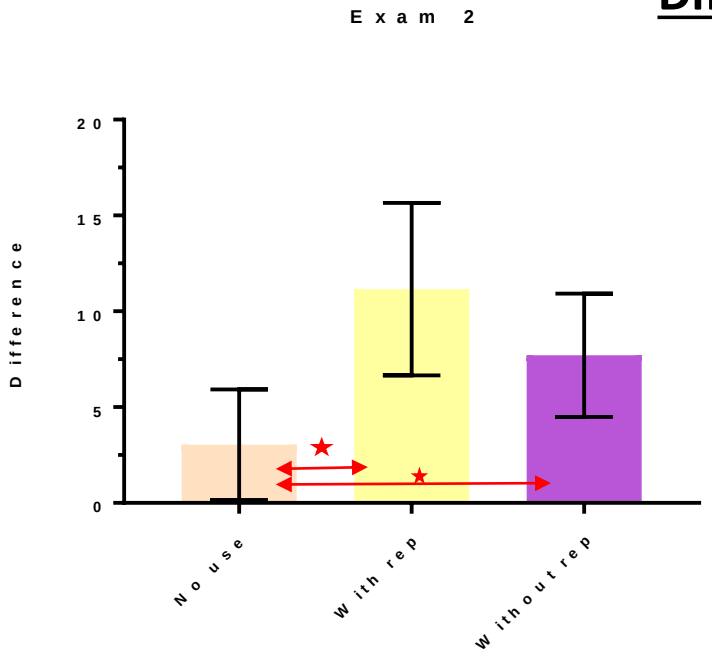
No use

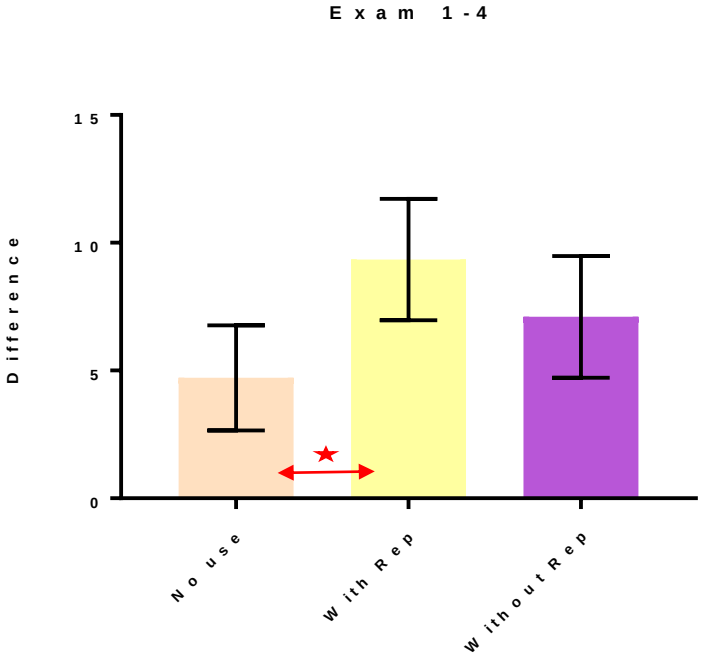
With rep

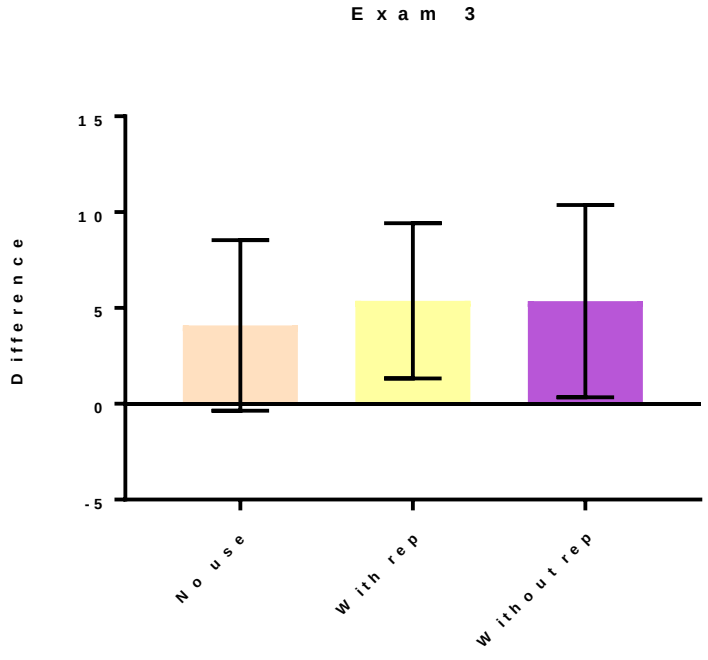
Without rep

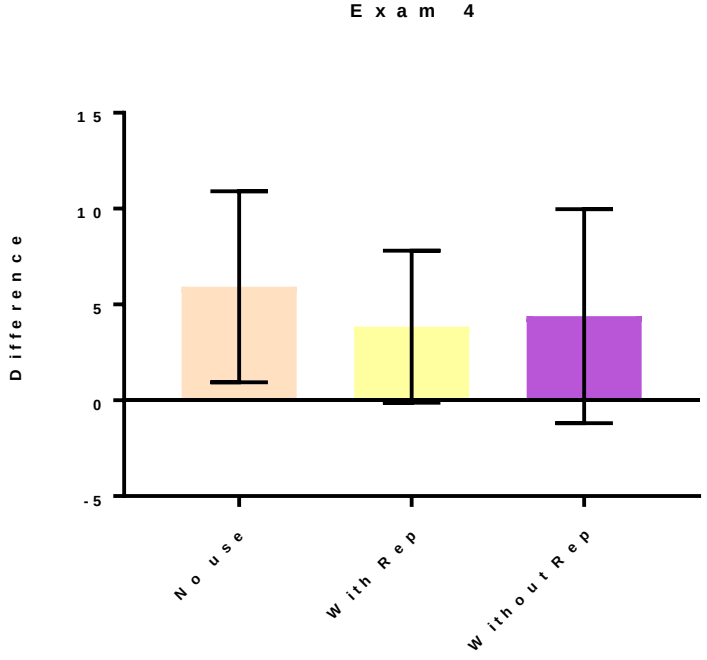
Difference Between Anki and Non-Anki Scores

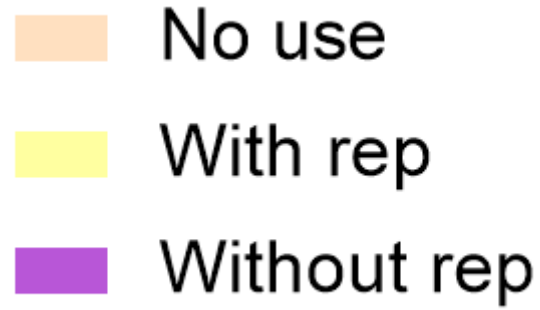












Challenges Encountered

- Students selecting multiple groups
- Unequal distribution of questions
- Coding of second order questions resulting in a control delta

Limitations

- Non-Random Assignment: Which students are using the resource?
- Administration of digital practical exams: Cannot generalize to in person cadaveric assessments
- No limitations on students expanding the resource deck for assessments – possible diminishing results over the course of the study

Lessons Learned

- Students utilizing spaced digital image identification outperform equated peers on associated questions
  - This finding is most pronounced early in the course
  - The decrease in trends is likely multifactorial in cause
- Future Implementations and Improvements on Resource
  - Increase the scope of the practice deck to span the entire course
  - As a large percentage of students utilized the resource without repetition or not at all, develop powerpoint files of images for easy access outside of ANKI

Future Questions

Do these trends extend to in person practical assessments?

Would a full course resource show significant improvement in student total scores in comparison to more traditional study methods?

Can this method of study be extended to courses outside of Medical Neuroanatomy?

Acknowledgements

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A special acknowledgement is extend to the donors and donor families who bequeathed their own bodies and the bodies of their loved ones to medical education and research through the Anatomical Gift Program at the Brody School of Medicine at East Carolina University

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Additional Data for Questions

Comparison	Mean 1	Mean 2	Observations 1	Observations 2	P-value
Total Score: *N* vs *R*	80.33	83.72	25	36	0.364
Total Score: *N* vs *NR*	80.33	83.44	25	26	0.449
Total Score: R vs NR	83.72	83.44	36	26	0.926
Anki Qs: *N* vs *R*	84.00	92.18	25	36	0.0051
Anki Qs: *N* vs *NR*	84.00	89.43	25	26	0.120
Anki Qs: *R* vs *NR*	92.18	89.43	36	26	0.166
Anki vs N-Anki: *N group*	84.00	77.4	25	25	0.198
Anki vs N-Anki: *R group*	92.18	77.66	36	36	9.81 E-08
Anki vs N-Anki: *NR group*	89.42	78.65	26	26	0.004
Delta: *N* vs *R*	6.60	15.24	25	36	0.017
Delta: *N* vs *NR*	6.60	10.77	25	26	0.238
Delta: *R* vs *NR*	15.24	10.77	36	26	0.23

Exam 1 Data. Key (*N*= No Use, *R*= Use with Repetition, *NR*= Use without Repetition, N-Anki= Non-Anki)

Comparison	Mean 1	Mean 2	Observations 1	Observations 2	P-value
Total Score: *N* vs *R*	85.81	85.15	37	26	0.819
Total Score: *N* vs *NR*	85.81	87.38	37	24	0.569
Total Score: R vs NR	85.15	87.38	26	24	0.413
Anki Qs: *N* vs *R*	87.5	91.35	37	26	0.155
Anki Qs: *N* vs *NR*	87.5	91.67	37	24	0.200
Anki Qs: *R* vs *NR*	91.35	91.67	26	24	0.894
Anki vs N-Anki: *N group*	87.5	84.46	37	37	0.292
Anki vs N-Anki: *R group*	91.34	80.19	26	26	0.0012
Anki vs N-Anki: *NR group*	91.67	83.96	24	24	0.0048
Delta: *N* vs *R*	3.04	11.15	37	26	0.0018
Delta: *N* vs *NR*	3.04	7.71	37	24	0.035
Delta: *R* vs *NR*	11.15	7.71	26	24	0.211

Exam 2 Data. Key (*N*= No Use, *R*= Use with Repetition, *NR*= Use without Repetition, N-Anki= Non-Anki)

Comparison	Mean 1	Mean 2	Observations 1	Observations 2	P-value
Total Score: *N* vs *R*	76.63	79.96	34	28	0.252
Total Score: *N* vs *NR*	76.63	75.93	34	21	0.807
Total Score: R vs NR	79.96	75.93	28	21	0.212
Anki Qs: *N* vs *R*	79.02	83.10	34	28	0.196
Anki Qs: *N* vs *NR*	79.02	79.04	34	21	0.993
Anki Qs: *R* vs *NR*	83.10	79.04	28	21	0.250
Anki vs N-Anki: *N group*	79.02	74.93	34	34	0.703
Anki vs N-Anki: *R group*	83.10	77.72	28	28	0.123
Anki vs N-Anki: *NR group*	79.02	73.67	21	21	0.133
Delta: *N* vs *R*	4.09	5.37	34	28	0.670
Delta: *N* vs *NR*	4.09	5.35	34	21	0.709
Delta: *R* vs *NR*	5.37	5.35	28	21	0.994

Exam 3 Data. Key (*N*= No Use, *R*= Use with Repetition, *NR*= Use without Repetition, N-Anki= Non-Anki)

Comparison	Mean 1	Mean 2	Observations 1	Observations 2	P-value
Total Score: *N* vs *R*	86.30	87.24	30	27	0.697
Total Score: *N* vs *NR*	86.30	85.60	30	27	0.767
Total Score: R vs NR	87.24	85.60	27	27	0.420
Anki Qs: *N* vs *R*	90.74	90.12	30	27	0.835
Anki Qs: *N* vs *NR*	90.74	88.89	30	27	0.529
Anki Qs: *R* vs *NR*	90.12	88.89	27	27	0.675
Anki vs N-Anki: *N group*	90.74	84.81	30	30	0.052
Anki vs N-Anki: *R group*	90.12	86.28	27	27	0.146
Anki vs N-Anki: *NR group*	88.89	84.50	27	27	0.107
Delta: *N* vs *R*	5.93	3.84	30	27	0.511
Delta: *N* vs *NR*	5.93	4.39	30	27	0.675
Delta: *R* vs *NR*	3.84	4.39	27	27	0.867

Exam 4 Data. Key (*N*= No Use, *R*= Use with Repetition, *NR*= Use without Repetition, N-Anki= Non-Anki)

Comparison	Mean 1	Mean 2	Observations 1	Observations 2	P-value
Total Score: *N* vs *R*	82.36	83.95	126	117	0.304
Total Score: *N* vs *NR*	82.36	83.39	126	98	0.518
Total Score: R vs NR	83.95	83.39	117	98	0.698
Anki Qs: *N* vs *R*	85.29	89.35	126	117	0.0076
Anki Qs: *N* vs *NR*	85.29	87.60	126	98	0.155
Anki Qs: *R* vs *NR*	89.35	87.60	117	98	0.225
Anki vs N-Anki: *N group*	85.29	80.57	126	126	0.008
Anki vs N-Anki: *R group*	89.35	80.01	117	117	3.34E-08
Anki vs N-Anki: *NR group*	87.60	80.50	98	98	2.66E-05
Delta: *N* vs *R*	4.72	9.34	126	117	0.0038
Delta: *N* vs *NR*	4.72	7.10	126	98	0.134
Delta: *R* vs *NR*	9.34	7.10	117	126	0.192

Exam 1-4 Data. Key (*N*= No Use, *R*= Use with Repetition, *NR*= Use without Repetition, N-Anki= Non-Anki)