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Background & Questions

- Threaded medical school curricula pose a challenge to long-term retention of microbiology and other basic science concepts central to medical examinations and clinical care
- Limited data exists on self-led, online spaced practice programs to teach basic science topics like microbiology
- The study sought to answer the questions:
 - Does participation in spaced practice learning of microbiology improve performance on NBME examinations?
 - Does performance on second-pass questions improve from first-pass attempts?

Figure 1: Sample Question

A 19-year-old woman visits an urgent care clinic complaining of pelvic pain, dysuria, and more recently, hematuria. A urine sample, when cultured on MacConkey agar, shows growth of pink colonies. Which of the following components of the causative microbe allows for adhesion to and internalization into macrophages?

| Total responders | Total responses | Total retired | Initial correct | Initial incorrect | Current correct | Current incorrect | Comments |
|------------------|-----------------|---------------|-----------------|-------------------|-----------------|-------------------|----------|
| 80 (95.24%) | 347 | 63 | 48 (60%) | 32 (40%) | 69 (86.25%) | 11 (13.75%) | 0 |

Initial presentation responses

To indicate how your question is performing the table below shows the distribution of responses on first presentation of the question

| Key | Choices | Responses |
|-----|--------------------|-----------|
| ✗ | Capsule | 4% |
| ✓ | Fimbria | 59% |
| ✗ | Flagellum | 20% |
| ✗ | Lipopolysaccharide | 10% |
| ✗ | Lipoteichoic acid | 1% |
| ✗ | Peptidoglycan | 2% |

82 responses

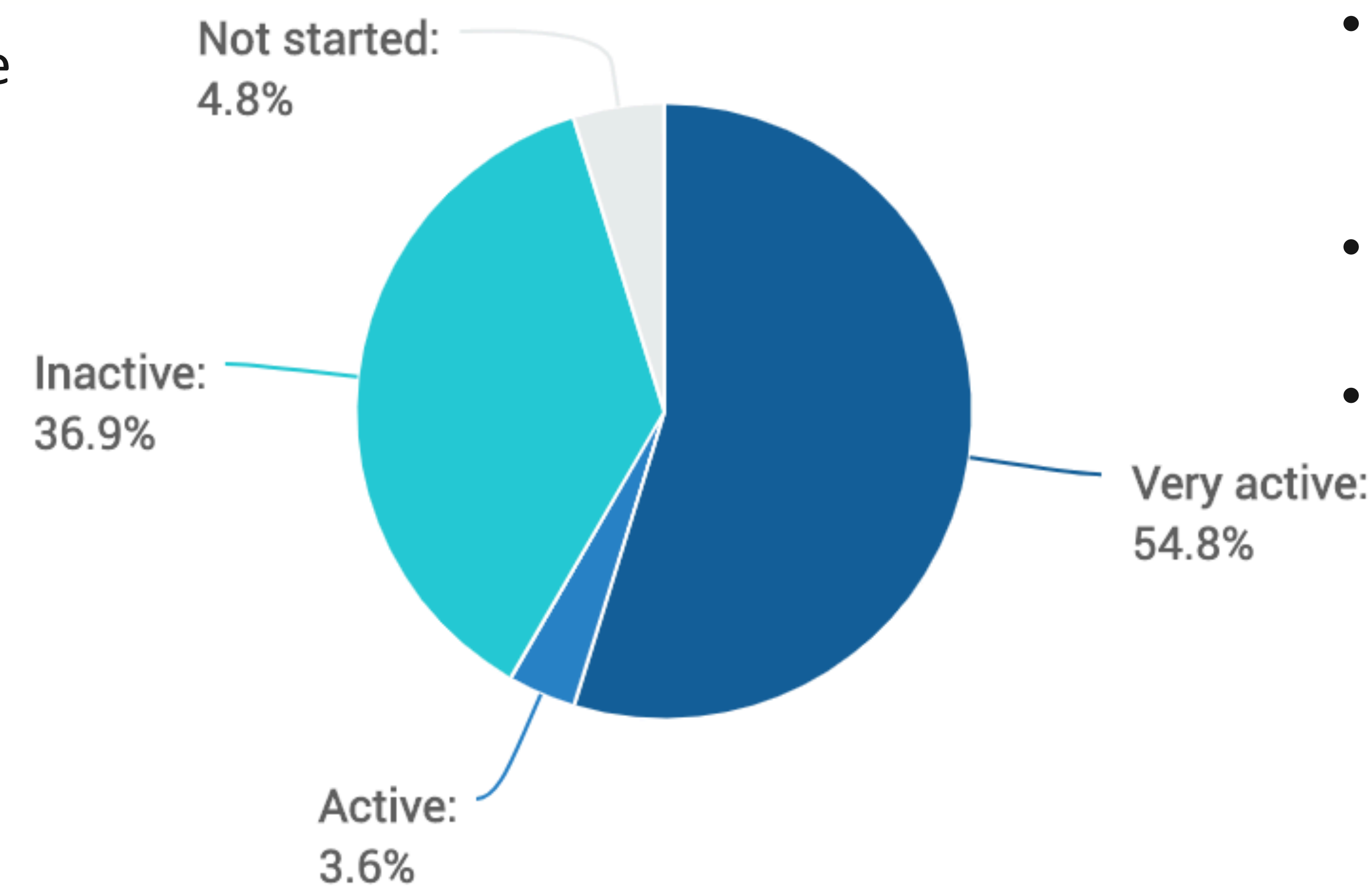


Figure 2: Participation in Spaced Practice Learning Platform by Activity Level

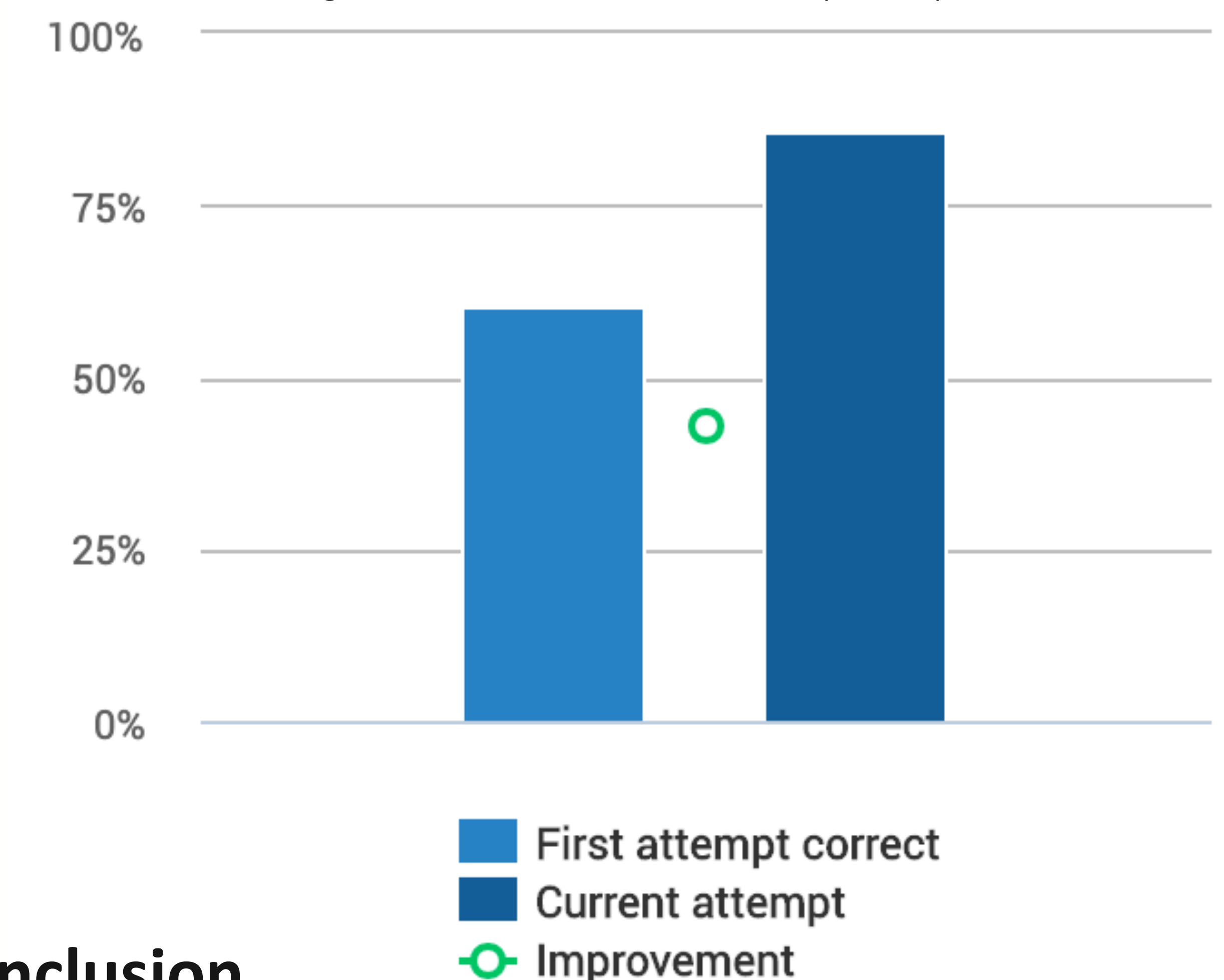
Methods

- Prospective cohort design study from August 2018 to December 2019
- Participants were volunteer first-year medical students at Oregon Health & Science University
 - 81 of 154 (53%) first-year medical students
 - MCAT Average: 510.95 (control: 510.14)
- Weekly participants answered 5-10 questions on the platform Qstream; questions were repeated according to an algorithm
- A total of 26,509 question attempts for 136 questions across 84 participants were collected

Results

- NBME Performance: Participants performed better than controls on the Skin, Bones, and Musculature ($p=0.0001$) and Developing Human ($p=0.008$) exams
- Second-Pass Performance: 41% improvement from first-pass to second-pass attempt on questions
- Improved performance on questions related to topics specifically covered in study questions compared to controls and NBME averages

Figure 3: Percent Correct on First and Repeat Response



Conclusion

- Online spaced practice is a feasible, cost-effective option for pre-clinical microbiology education, with possibilities for learning in other basic and clinical science fields

References

- Price Kerfoot, Interactive Spaced Education Versus Web Based Modules for Teaching Urology to Medical Students: A Randomized Controlled Trial, *The Journal of Urology*, 179, 6, (2351), (2008).
 - Guarner J, Burd EM, Kraft CS, Armstrong WS, Lenorr K, Spicer JO, Martin D, del Rio C. 2015. Evaluation of an online program to teach microbiology to internal medicine residents. *J Clin Microbiol* 53:278-281.
 - Guarner J, Armstrong W, Satola S, Mehta A, Jerris R, Hilinski J, Burd E, Kraft C, del Rio C. 2013. Development, implementation, and evaluation of a 4th year medical school elective course in clinical microbiology using case-based vignettes. *J Med Microbiol* 62:1098-1110.
- Acknowledgments:** Funding for the project was provided through the IDSA Foundation and the Oregon Health & Science University Innovations in Education Mini-Grant.
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