

1-18-2018

## Voluntary Web-Based Self-Assessment Quiz Use Improves Exam Performance, Especially for Learners with Low Prior Knowledge

Jenifer C. Utz

University of Nevada, Las Vegas, [jenifer.utz@unlv.edu](mailto:jenifer.utz@unlv.edu)

Matthew L. Bernacki

University of Nevada, Las Vegas, [matt.bernacki@unlv.edu](mailto:matt.bernacki@unlv.edu)

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### Recommended Citation

Utz, Jenifer C. and Bernacki, Matthew L., "Voluntary Web-Based Self-Assessment Quiz Use Improves Exam Performance, Especially for Learners with Low Prior Knowledge" (2018). *UNLV Best Teaching Practices Expo*. 24.

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# Voluntary Web-Based Self-Assessment Quiz Use Improves Exam Performance, Especially for Learners with Low Prior Knowledge

Jenifer C. Utz, College of Sciences  
Matthew L. Bernacki, College of Education

## Abstract

We examined students' voluntary use of digital self-assessment quizzes as a resource for learning in a large anatomy and physiology lecture course. Students (N = 238) could use 16 chapter quizzes and four analogous unit quizzes to rehearse and self-assess knowledge. Repeated use was uncommon (12%), as was lack of use (13%). Most students (75%) engaged in occasional use of self-assessment quiz items. Exam performance differed between repeated use (84%), occasional use (76%), and no use (72%) groups. Differences were greater among students who lacked prior knowledge of course topics. Quiz use improved performance more for low prior knowledge students, and differences increased over the semester. Overall, repeated users significantly outperformed occasional users (+7.5%) and non users (+11.9%) on course exams.

## Methods

Data were collected from students (N = 238) enrolled in the Human Anatomy & Physiology I course at UNLV during the Fall semester of 2015. The undergraduate population at UNLV is diverse, and students enrolled in the A & P course generally reflect the demographics of the larger population (Figure 1).

The A & P course has an associated Blackboard Learn (learning management system) course site where a variety of resources are available to students (e.g., learning objectives, lecture presentations, and self-assessment quizzes). Students were introduced to these resources during the first lecture of the semester and utilized them on a voluntary basis thereafter. After the semester ended, we investigated the effect of self-assessment quiz use and prior knowledge on exam performance. Prior knowledge levels (terciles: low, mid, high) were assigned based on a 30-item pre-test given at the start of the semester that covered general biology content discussed in the prerequisite course. Students were also categorized into groups based on the number of self-assessment quiz items attempted (Figure 2). Students in the "no use" group attempted 0 quiz items; students in the "occasional use" group spanned use from 1 item through 400 items; students in the "repeated use" group spanned from 1478 items. Data were analyzed via repeated measures ANOVA in SPSS;  $p < .05$  was considered statistically significant.

## Description of Self-Assessment Quizzes

All quizzes were composed of a mixture of multiple choice and fill-in-the-blank style questions. A pool of approximately 35 questions was created for each chapter. Chapter quizzes contained 15 items randomly selected from the pool. Unit quizzes containing 40 items and a 100-item comprehensive quiz covering all chapters were also available. After submitting a quiz, students received feedback on the correct response as well as the corresponding section of the text.

Figure 1. UNLV Undergraduate Population

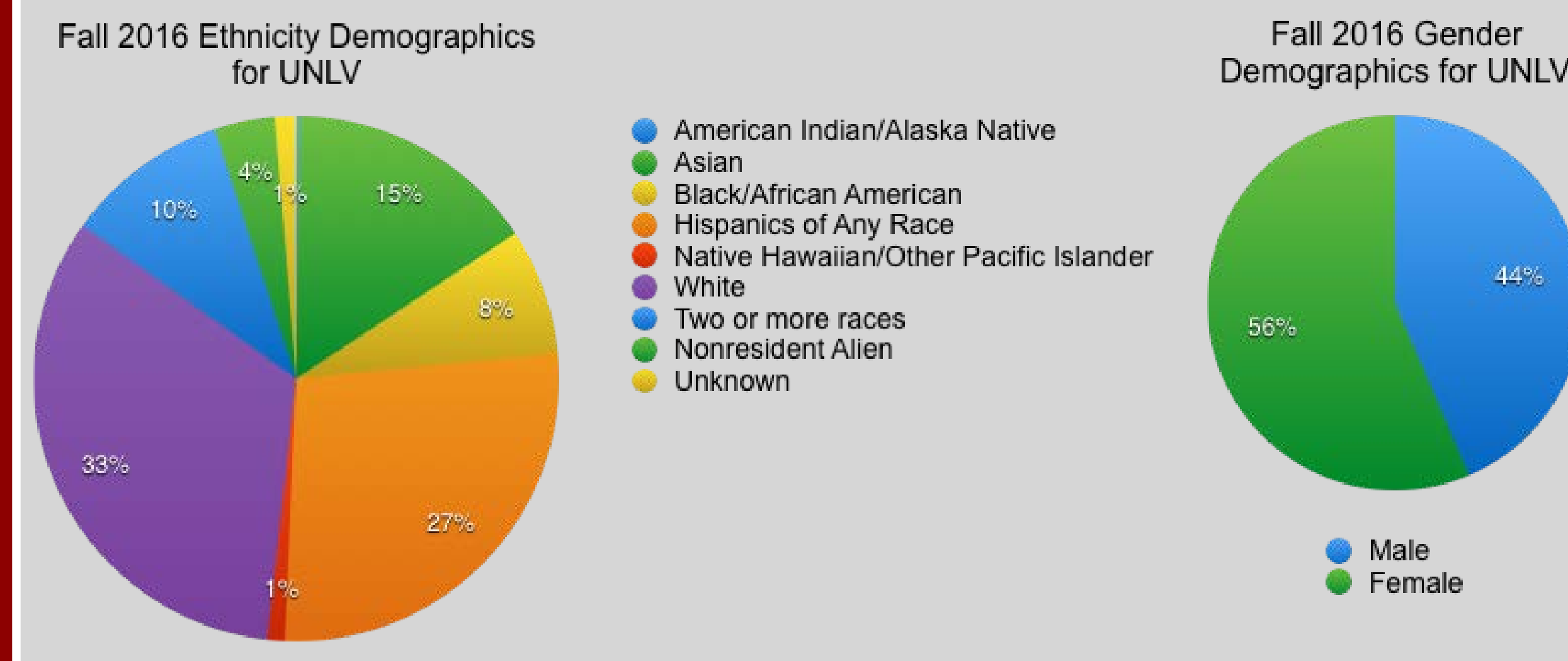
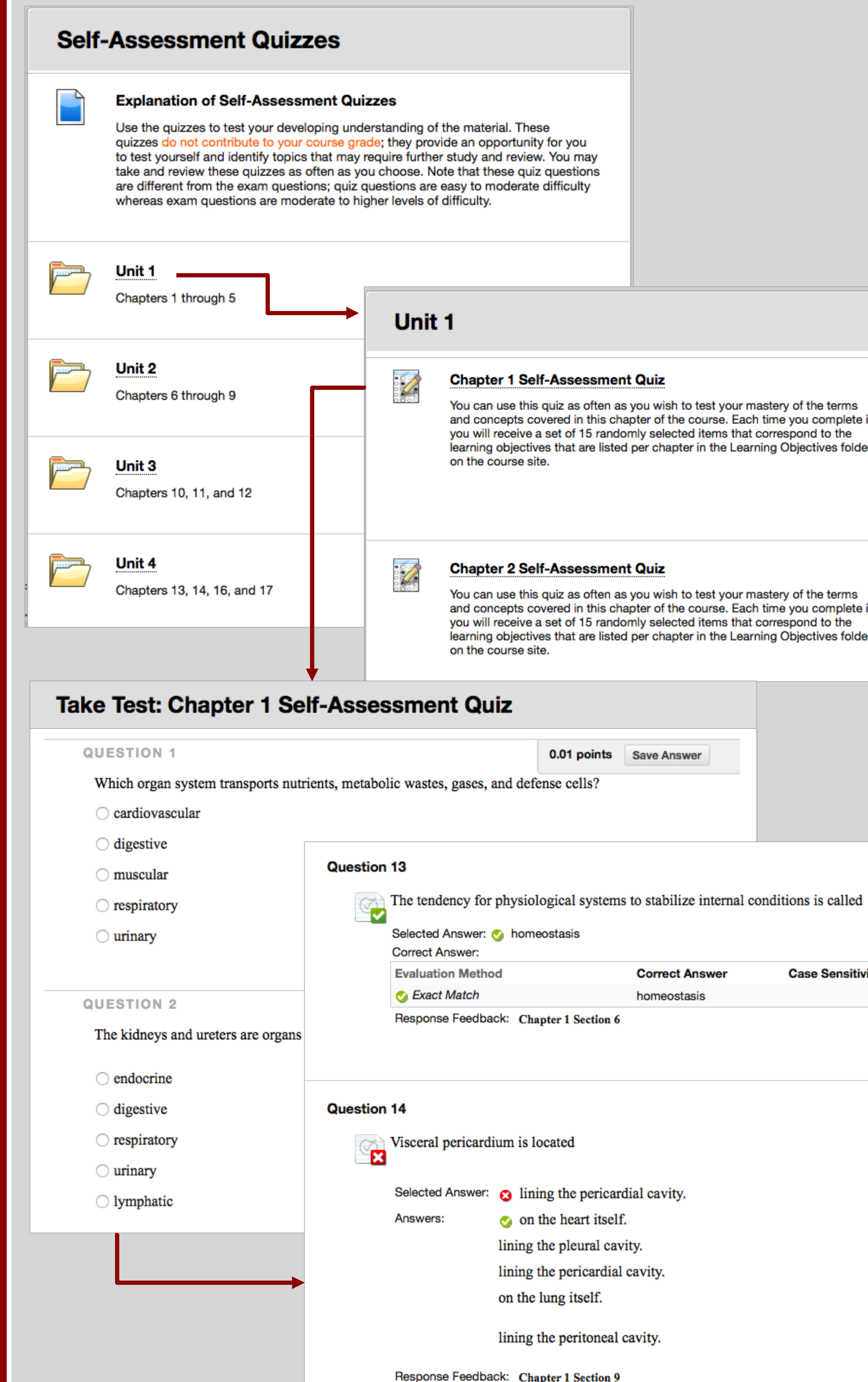
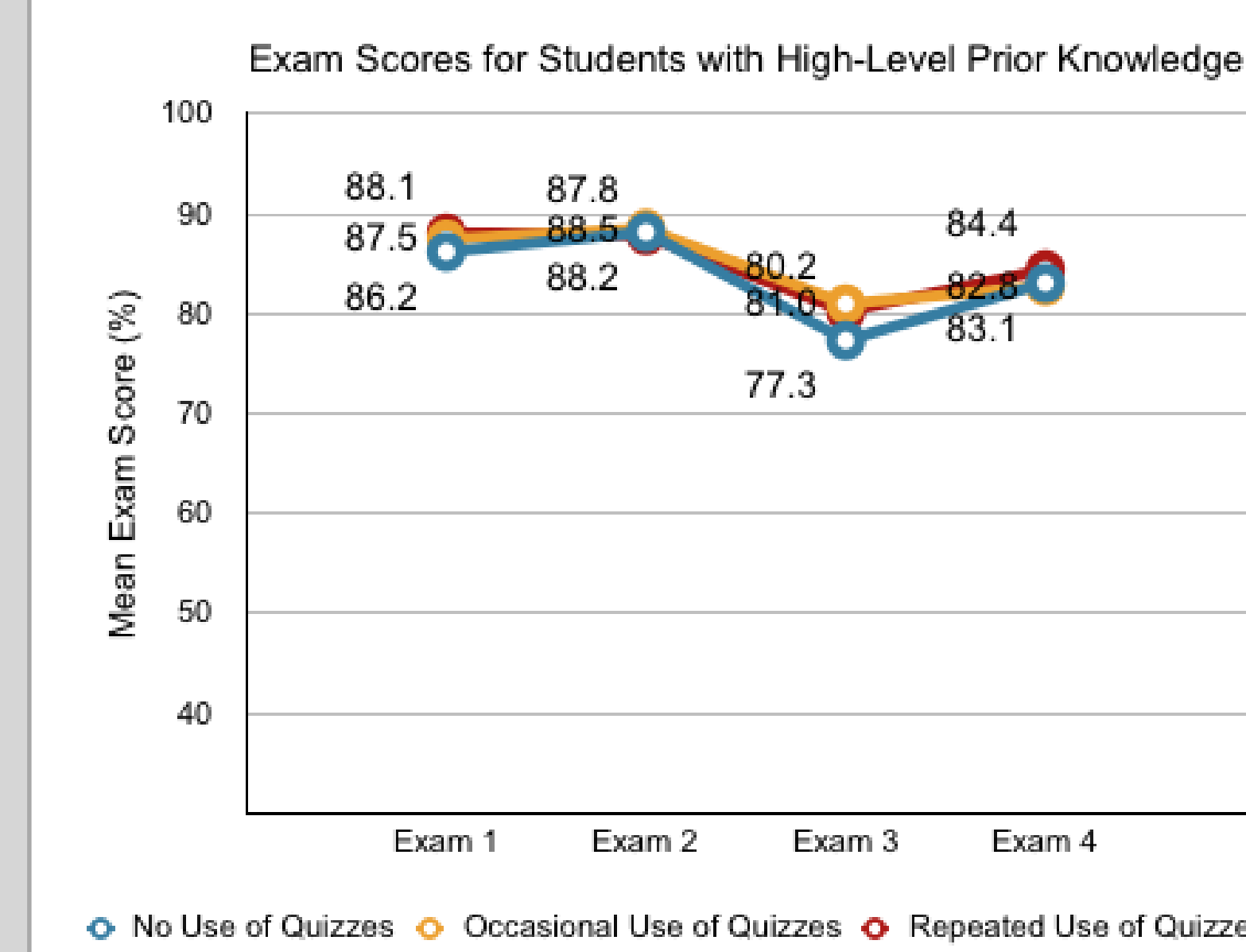
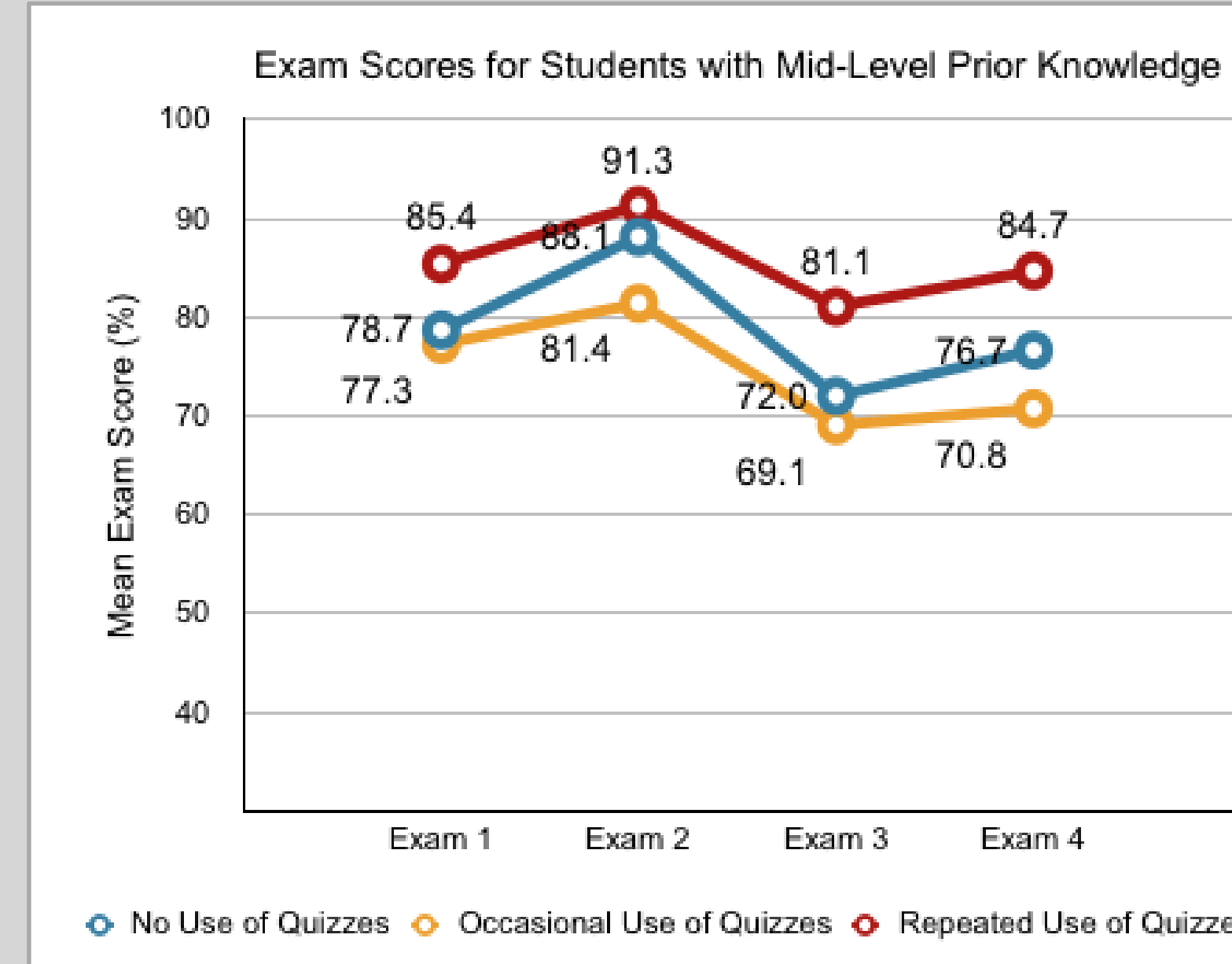
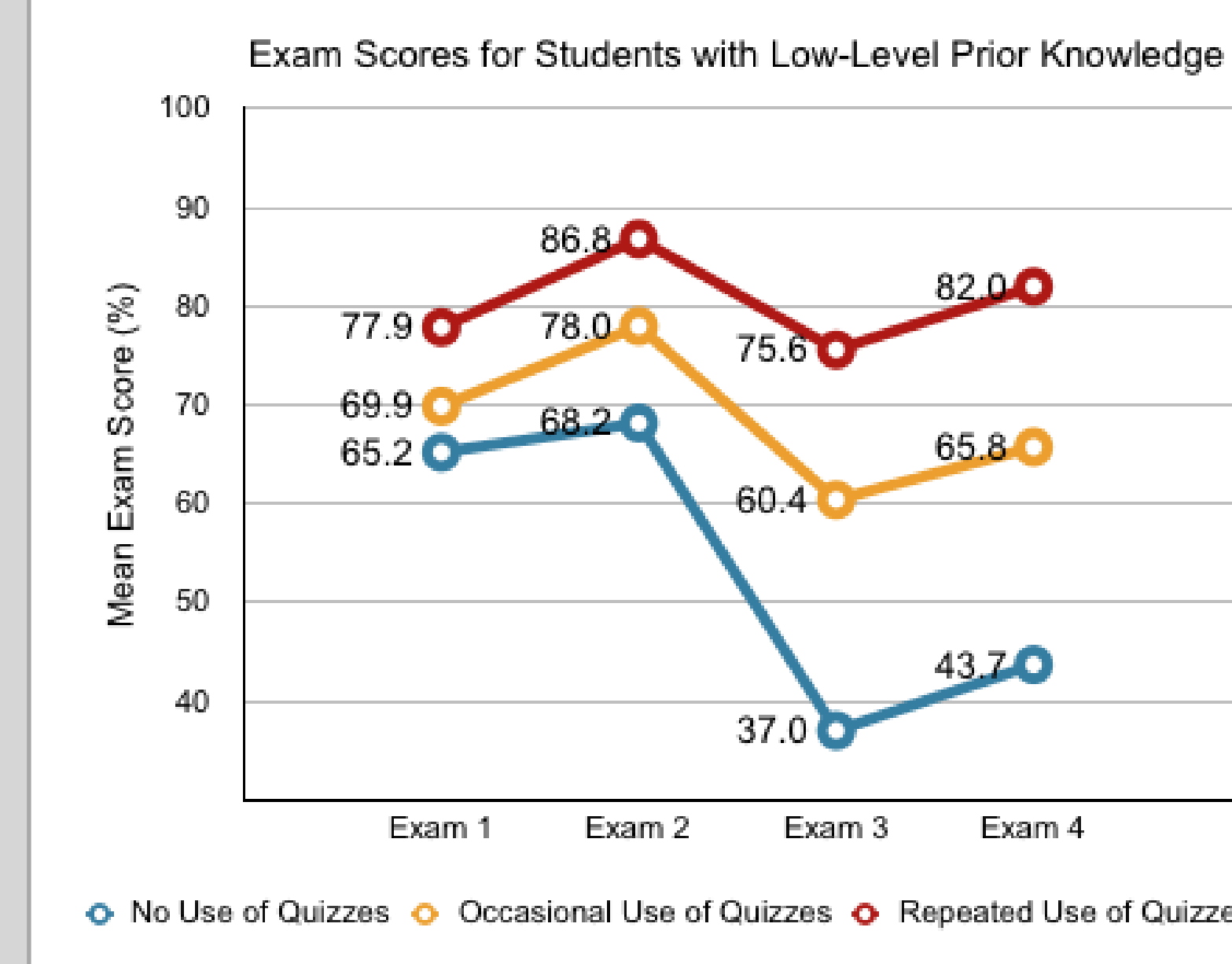
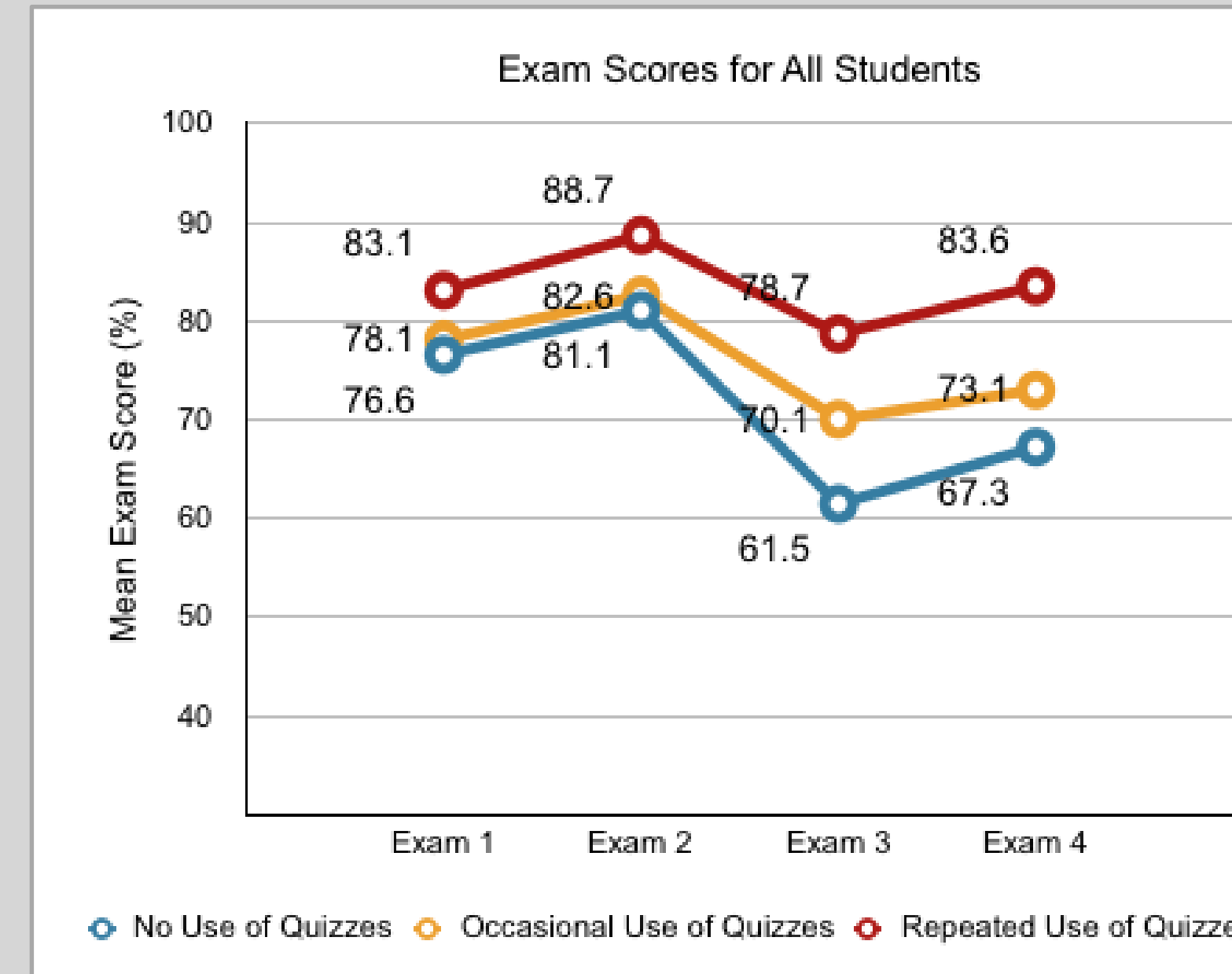


Figure 2. Student View of Self-Assessment Quizzes



## Results



## Description of Exam Content

Exams 1 through 3 were unit exams composed of 50 multiple choice questions and 2 short answer questions covering the following topics:

- Exam 1: homeostasis, chemistry, cells, tissues, and integumentary system
- Exam 2: osseous tissue, axial skeleton, appendicular skeleton, and articulations
- Exam 3: muscle tissue, muscular system, and neural tissue

Exam 4 was a comprehensive final exam composed of 100 multiple choice questions. Forty questions covered material from the final unit (spinal cord, brain, autonomic nervous system, and special senses) while the remaining 60 questions covered material from the 3 previous units.

## Key Findings

- A majority of students (87%) engaged in some voluntary use of quizzes that were explicitly intended for self-assessment (i.e. not required, no questions duplicated on exams, no direct contribution to course grade).
- Student use of self-assessment quizzes had a significant effect on course exam performance,  $F(2, 229) = 5.89, p = 0.003$ .
- Student prior knowledge level had a significant effect on course exam performance,  $F(2, 229) = 18.18, p < 0.001$ .
- An interaction between self-assessment quiz use and prior knowledge level was demonstrated  $F(4, 229) = 3.51, p = 0.008$ .
- Students who repeatedly used self-assessment quizzes scored 7.55% higher on course exams than students who occasionally used quizzes (LSD;  $p = 0.006$ ).
- Students who repeatedly used self-assessment quizzes scored 11.92% higher on course exams than students who did not use quizzes (LSD;  $p = 0.001$ ).
- Quiz use for students with low prior knowledge was particularly beneficial, repeated users outperformed non-users by nearly 40% on exams 3 and 4 and occasional users outperformed non-users by more than 20% on these exams.

## Summary and Implications

Human Anatomy & Physiology courses are notoriously difficult, and students often enter these courses underprepared. We investigated the effect of voluntary use of self-assessment quizzes on exam performance. We found that digital quiz use substantially improved exam performance, particularly for students with low levels of prior knowledge. This type of course enrichment could benefit students at many diverse institutions.

### Practical Considerations:

- Development and implementation of self-assessment quizzes requires a reasonable time investment from the instructor.
- Learning Management Systems (i.e. Blackboard, Canvas) can be utilized to provide learning supports in both large and small enrollment settings as well as for in person and online course formats.
- Students entering the course with low levels of prior knowledge who repeatedly used self-assessment quizzes were able to "close the achievement gap", earning final exam scores within 2% of peers who entered the course with high levels of prior knowledge.