

Research Gaps

- The human anatomy is regarded as a cornerstone of health care disciplines and is a pre-requisite for subsequent years of medical, allied health and nursing theory courses and clinical (Young et al., 2016).
- Numerous studies have expressed concern over students' ability to acquire anatomical knowledge in the first year and successfully transfer, retain, and apply it throughout their program (Narnaware and Neumeier, 2020; Narnaware, Y. 2021).
- Several robust interventional strategies have been employed in medicine and allied health disciplines to overcome the gap between first-year theory to senior years of theory and clinical (Manyama et al., 2016).
- However, these interventions are lacking in nursing education. We have previously shown that nursing students lose anatomical knowledge by approximately 30.0% over three years (Narnaware, Y. 2022).

Study Objectives

- To improve the acquisition and retention of anatomical knowledge, the present study aims to evaluate an interventional strategy that includes the content reinforcement (repeated knowledge testing) of the muscular and skeletal systems over eight weeks that will help improve knowledge retention.

Methods

- The present study was conducted in the Fall 2022 semester with two sections of the anatomy of 80 students each. Quizzes were created using an online quizzing platform called Kahoot (Kahoot Inc., Oslo, Norway) to assess content reinforcement of the skeletal and muscular systems over eight weeks. The students were encouraged not to study for Kahoot quizzes in advance.
- Between seven and nine, multiple-choice questions reflecting first-year anatomical knowledge of these organ systems were developed into 6 Kahoots per organ system over eight weeks, and new sets of questions were used for each week's Kahoot quiz.

Table 1. Percent Change in Knowledge Retention of Muscular and Skeletal Systems Over Eight Weeks in Nursing Students

Organ System	Percent (%) Change					
	Week 1	Week 2	Week 3	Week 4	Week 6	Week 8
Muscular System	100%	-3.4	+6.2	-20.9	+5.3	-3.3.
Skeletal System	100%	+20.0*	+19.4	-4.3	+28.5**	+1.4

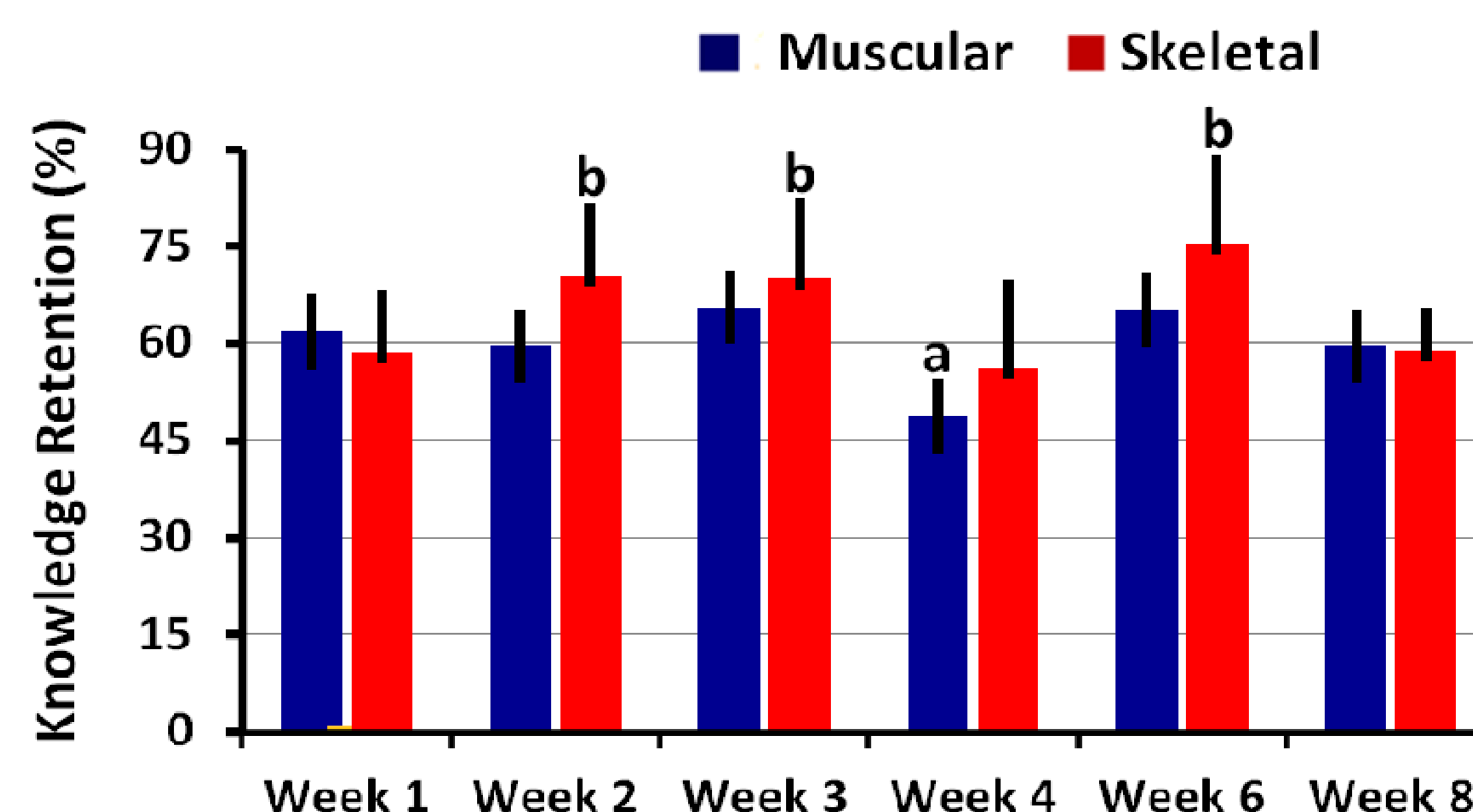
Data shown as means \pm (standard deviation). Percentage change in knowledge retention over eight (8) weeks compared to week 1. *P<0.05, ** P<0.01).

Methods Continue...

- Data were statistically analyzed using SPSS II, and means were compared using 2-sample t-tests. The scores are described as the mean and standard deviation (SD) and are presented in table 1 and figure 1. Statistical significance was set at $P \leq 0.05$ for all tests.

Results

- Compared to week 1, repeating knowledge of the muscular system yielded a slight decrease in knowledge retention in week 2 (-3.4%) and week 8 (-3.3%) but was significantly lower in week 4 (-20.9%).
- Whereas retention was comparatively higher at week 3 (+6.2%) and week 6 (+5.3%) compared to week 1 (Table 1 and Fig.1).
- In comparison to the muscular system, repeating anatomical knowledge of the skeletal system over eight weeks resulted in a significant increase in knowledge retention at week 2 (+20.0%) and week 3 (+19.4%) and week 6 (+28.5%) compared to week 1.
- Whereas anatomical knowledge was slightly lower at week 4 (-4.3%) but slightly higher at week 8 (+1.4%) compared to week 1 (Table 1 and Fig.1).



Impact of content reinforcement on knowledge retention of the musculo-skeletal systems over eight weeks in nursing students. a, b compared to week 1; P<0.05, P<0.001.

Discussion & Conclusion

- The higher retention in weeks 3 and 6 for the muscular system and weeks 2, 3 and 6 for the skeletal system may be, in part due, that students were reading these organ systems for the midterm exams.
- Although organ system-specific changes in knowledge retention were found, the study results show that nursing students were able to retain the knowledge of the muscular and skeletal systems over eight weeks and had better knowledge retention of the skeletal system than the muscular system after eight weeks of repeated knowledge assessment.
- No comparable data on content reinforcement of these systems are available in allied health and nursing students.
- The results of this study are consistent with those of medical students (Anderson et al., 2016) and nursing students in the cardiovascular physiology content reinforcement study reported earlier (Narnaware, Y. 2022).
- Therefore, content reinforcement should be used as one of the interventional strategies to improve knowledge retention in nursing students, and further research should be conducted to evaluate effective ways to maintain increased retention over more extended periods.

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