The Effect of Cooperative Quizzes on Student Performance and Anxiety in Community College Human Physiology Courses

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Abstract

Community college students come from a variety of backgrounds and have different levels of educational preparedness compared to undergraduates in 4-year undergraduate schools. Historically, retention rates of these students in human physiology courses have been low, often due to non-passing grades. Incorporation of additional active learning techniques has the potential to benefit learning in this group, which might ultimately benefit retention. However, active learning activities need to be incorporated in a thoughtful manner, because some activities can increase anxiety in students, resulting in unintended consequences such as student withdrawal from such activities. This study introduced cooperative quizzes into community college human physiology classes to determine if they improved student exam performance and reduced student anxiety. The cooperative quizzes were intended to be given in face-to-face classes but were adapted for synchronous broadcast classes using Zoom due to the COVID-19 pandemic. In the sample of students studied, cooperative quizzes did not have a significant impact on exam grades. However, several students reported a preference for the cooperative quizzes over traditional quizzes. In addition, the intervention did not increase the reported anxiety scores among students, which adds support for the use of cooperative quizzes as an active learning strategy in STEM classes. https://doi.org/10.21692/haps.2021.016

Key words: cooperative quizzes, anxiety, physiology, community college

Introduction

Community college students come from a variety of cultural backgrounds and have different levels of educational preparedness compared to students entering traditional 4-year colleges (Flynn et al. 2017). Human physiology is commonly a high-enrollment course in community colleges because it serves as a prerequisite into a wide range of healthcare degree programs. However, it is a challenging subject for many students because new concepts build on prior knowledge. Unfortunately, students in these courses may have difficulty recalling or may even have insufficient or inaccurate prior knowledge (Ambrose et al. 2010). In addition, students struggle with causal reasoning, predicting physiological outcomes, interpreting graphs, and using equations (Michael 2007). Retention rates of students in human physiology courses, especially among minority and first-generation college students, reflect the low retention rates of STEM courses in general (England et al. 2019).

It has been demonstrated that active learning practices are more effective in increasing student achievement in STEM courses compared to traditional lecturing (Freeman et al. 2014). Active learning practices encourage students to engage with, and make sense of, course content through interactive activities such as jigsaw activities, think-pair-share, game-based learning, and collaborative quizzing (Bernstein 2018). Freeman et al. (2014) found in their meta-analysis that active learning practices increased the performance and retention of students (including female students) in STEM.

Although active learning has been shown to increase student performance, some student subpopulations may benefit more than others. For example, Eddy and Hogan (2014) found that a moderate-structure intervention (ungraded, pre-class guided-reading questions, graded weekly preparatory homework, in-class student discussions) in an introductory biology class for mixed-majors increased performance in Black student and first-generation student populations more than in other groups. However, some active learning practices have been found to cause more student anxiety than others. Contrary to Eddy and Hogan's findings (2014), Hood et al. (2020) found that first-generation and minority community college students in human physiology and anatomy classes experienced more anxiety in response to active learning techniques, especially those that involved public or social interaction (e.g. answering clicker questions in partners). This is a concern because high anxiety can negatively affect student performance and persistence in STEM courses (Hood et al. 2020).

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The active learning method of cooperative quizzes, where students take a quiz first as an individual and then again as a member of a small group, has been shown to increase student performance in a four-year college anatomy and physiology course (Jensen et al. 2002). By working on a low-stakes quiz in a group, students obtain immediate feedback from peers on concepts that they do not understand well, which allows them to fill in their knowledge gaps (Rao et al. 2002). Student misconceptions are also challenged by peers which can add to the learning experience. In addition, when peers confirm that a student's answer on the individual quiz is correct, that student's academic self-confidence increases (Zimbardo et al. 2003). Thus, by discussing each quiz item and teaching each other, students gain a better understanding of the concepts and improve their performance (Rao et al. 2002).

Cooperative quizzes also have the benefit of increasing interpersonal skills, such as negotiation and the ability to explain concepts to others, which students will need in their future careers (Johnson et al. 1991). Working in groups has also been found to improve relationships among students, promote a sense of community in the classroom (Johnson et al. 1991), and increase students' enjoyment as well as persistence in STEM courses (Springer et al. 1999). This increased engagement may lead students to invest more effort, which should increase their mastery of course material.

To help determine if findings involving 4-year university students (Jensen et al. 2002) are applicable to the generally more diverse community college population, this study introduced the use of cooperative quizzes into traditional, lecture-based community college human physiology classes that met synchronously in a broadcast format. The aims of this study were to answer the following questions:

1. Do cooperative quizzes improve student performance on related lecture exam questions?
2. Does the use of cooperative quizzes impact student anxiety?

Methods

The Course and the Students

This research was conducted in two 17-week semester-long community college human physiology lecture classes taught by one of the authors (KB) during the fall semester of 2020. The classes met synchronously twice per week for 80 minutes in a broadcast format. These students had completed the prerequisites of first-year college biology and first-year college chemistry with a C or better, and many of them had also already taken human anatomy, although it was not a prerequisite to human physiology. Students were also enrolled in the corequisite human physiology lab, which was taught online due to the COVID-19 pandemic. The lab was graded separately from the lecture class. Most of these students were sophomore pre-health science majors or undeclared majors, with many going on to nursing or other healthcare programs.

Students were assessed by four semester exams, with the lowest exam dropped, and a final exam. These exams counted toward 68% of a student's class grade. A week before each of the four semester exams, either an individual quiz or an individual quiz followed by a cooperative quiz was given to prepare students for the upcoming semester exam. These four quizzes were worth 10% of the final grade. Weekly homework on each chapter and case studies were each weighted an additional 10% of the final grade. Students also presented a recent physiology-related scientific article to the class, which was worth the final 2% of their grade. Class attendance was highly encouraged but not mandatory. The majority of students participated in the quizzes, which were given during class time. Make-up quizzes were given only under exceptional circumstances.

The two sections of human physiology were randomly assigned as section A (n=19) and section B (n=12). Students self-selected their section prior to the study based on the time of day the class met. Informed consent was obtained from all participants and this project was approved by the Salt Lake Community College Institutional Research Board (#9574).

Survey

Students were invited to voluntarily complete the same online 62-question survey via Qualtrics at the beginning (pre-survey) and end of the semester (post-survey). Most of the questionnaire, except the copyrighted six-item State-Trait Anxiety Inventory (STAI-6) and mini-SPIN questions, is available in Appendix 1. The pre- and post-surveys were linked for each student by their name, which was removed by an independent third party before the instructor received the data after final grades were submitted.

Students were asked their current GPA and estimated final grade in the class. Students were also asked the following demographic information: which gender they identified with, their ethnicity, and if they were a first-generation college student. The gender options that students could select were male, female, transgendered man, transgendered woman, genderqueer, nonbinary, other, or prefer not to say. The categories for ethnicity that students could choose from were White, Black or African American, Hispanic, American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, other, or prefer not to say.

We adapted a Likert-type scale devised by England et al. (2017) to ask students to rate classroom practices (e.g., lecturing, taking a cooperative quiz, taking a quiz alone) in terms of how much anxiety each activity caused them to experience on a scale of 1 (no anxiety) to 5 (extreme anxiety). See Appendix 1 for the full list of questions. We

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also asked students to rate how much these same classroom practices contributed to their learning from 1 (very little) to 5 (significantly) and to explain why some strategies were helpful. Additionally, students were asked whether they preferred to take an individual quiz or a cooperative quiz and to explain why. We also asked students whether they preferred to choose their own group or have the instructor assign groups for the cooperative quiz.

State anxiety (how much anxiety one feels currently) was measured with the six-item State-Trait Anxiety Inventory (Marteau and Bekker 1992) where students were asked to read a short statement and rate if they felt that way on a scale of 1 (almost never) to 4 (almost always). Social anxiety (the fear of being negatively judged in social situations) was evaluated in students by using the three-item mini-social phobia inventory (mini-SPIN) (Connor et al. 2001). Students were asked to read a statement describing a social phobia situation and then rate how much it had bothered them in the past week from 0 (not at all) to 4 (extremely).

To evaluate how students were coping with stress, a subset of ten questions from the brief COPE survey (Carver 1997) was given. In response to statements such as "I've been getting help and advice from other people," students chose to what extent they have been doing the event between 1 (I haven't been doing this at all) and 4 (I've been doing this a lot).

Academic self-efficacy, which is a student's confidence in their ability to succeed academically, was evaluated using a ten-question survey developed by McIlroy (2010). Students indicated their level of agreement with statements such as "I am confident that I will be adequately prepared for the exams by the time they come around" by selecting between 1 (strongly disagree) to 7 (strongly agree).

Not all of the data collected in this survey was analyzed for the current publication because this study focused on the impact of cooperative quizzes on student exam performance and student anxiety. Some data will be analyzed later as part of the National Science Foundation's Community College Anatomy and Physiology Education Research (CAPER) Award Number 1829157 (https://nsf.gov/awardsearch/showAward?AWD_ID=1829157&HistoricalAwards=false), which is investigating how different active learning activities are perceived by community college students and how they affect student anxiety levels, academic self-efficacy, and grades (Hood et al. 2020; Hood et al. 2021).

Cooperative Quizzes

Students in section A took only an individual quiz before semester Exams 1 and 2 and an individual quiz followed by a cooperative quiz before Exams 3 and 4. This sequence occurred in the opposite order for section B. Table 1 shows a schematic of the order in which the quizzes were given. Originally, we were going to test whether being assigned to a group or self-choosing a group impacted anxiety in cooperative quizzing, but the use of breakout rooms on Zoom made it difficult for students to choose their own groups easily.

Section A	Section B
Individual quiz 1	Individual quiz and cooperative quiz 1
Exam 1	Exam 1
Individual quiz 2	Individual quiz and cooperative quiz 2
Exam 2	Exam 2
Individual quiz and cooperative quiz 3	Individual quiz 3
Exam 3	Exam 3
Individual quiz and cooperative quiz 4	Individual quiz 4
Exam 4	Exam 4

Table 1. *Schedule of administration of individual and cooperative quizzes before each semester exam for Section A and Section B.*

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Each quiz was completed in a learning management system (LMS) and consisted of ten multiple choice questions and two short essay questions with a fifteen-minute time limit to complete the quiz individually. All questions were written by the instructor and reviewed for content validity by a human physiology instructor at Salt Lake Community College who was not involved in the study. Groups were given twenty minutes to complete the cooperative quizzes to allow more time for discussion of the questions among the group members.

Semester exams consisted of 40 multiple choice questions (worth 1 point each) and 20 points on the short essay questions, and students were given 80 minutes to complete the exam. All quizzes and exams were open book/course notes, but not open internet and no proctoring program was used. The instructor discussed academic integrity and the consequences of violating it with students and encouraged them to not use the internet while working on quizzes and exams.

In the section where a cooperative quiz was to be given, students met online synchronously in the broadcast format and first took the quiz individually in the LMS. Following completion of the individual quiz, students were assigned to groups of two to three students in breakout rooms to re-take the individual quiz as a cooperative quiz. Groups of two to three were chosen to ensure that all students interacted with each other (Rao et al. 2002). The instructor chose at least one stronger performing student to be in each group. Prior to the first cooperative quiz, it was more difficult to determine who the higher performing students were. Instead, homework grades were used to choose the higher performing student in each group, with each group assigned at least one student who had a homework score of 90% or above. The instructor changed group members for the second cooperative quiz. While students were taking the cooperative quiz, the instructor circulated between the breakout rooms to check on progress, answer questions, and make sure groups were functioning as directed.

Before starting the cooperative quiz, students were instructed that each group member had to share their preferred answer. If there was disagreement between answers, then each group member had to explain their reasoning for their answer choice and come to a group consensus. One student in the group was chosen to record the answers, and each group member received the same score for the cooperative quiz. A student's final quiz score was calculated by adding 80% of the individual quiz score and 20% of the cooperative quiz score together (Rao et al. 2002). The cooperative quizzes were graded, and questions and correct answers were visible by the end of the day to students on the LMS. The instructor reviewed the cooperative quiz answers the next class period and answered questions.

Data Analysis

Performance on quiz-related exam questions was compared between students who took an individual quiz only and students who participated in cooperative quizzing before the exam. The exam score data from all four exams was analyzed with the Shapiro-Wilk normality test and found to be normally distributed ($p>0.05$). To determine if a significant difference in exam scores existed between the two groups, an independent samples t-test was used. An independent samples t-test was also used to ascertain if significant differences were present in mean grades on quiz-related exam questions between first-generation and continuing-generation status students as well as based on gender self-identification and ethnicity. Where the data were nonparametric, the Mann-Whitney U test was used to compare the groups.

From the surveys given at the beginning and end of the semester, student self-reported mean anxiety levels ± SD caused by cooperative quizzes and individual quizzes were calculated. An independent samples t-test was used to determine if significant differences were present in social anxiety levels as measured by the mini-SPIN questions on the survey between first-generation and continuing-generation status students, gender, and ethnicity. Additionally, matched student comments in pre- and post-survey comments were analyzed to determine changes in preference for quiz type.

Results

Study Population

Table 2 summarizes the demographic characteristics of 22 of the 31 students enrolled in both sections that completed the survey at the beginning of the semester. Data pertaining to age was not collected.

Gender	63.6% female (n = 14) 36.4% male (n = 8)
Ethnicity	68.2% White (n = 15) 13.6% Asian (n = 3) 13.6% Hispanic (n = 3) 4.5% Black (n = 1)
First-generation?	61.9% no (n = 13) 38.1% yes (n = 8)

Table 2. *Demographic data pertaining to students in sections A and B that completed the pre-survey (n=22).*

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Effect of Cooperative Quizzes on Exam Performance

Students, regardless whether they were in section A or B, who took a cooperative quiz before the exam earned a mean of 82.7 ± 11.3% on quiz-related exam questions, which did not differ significantly (p=0.171) from the mean score of 80.7 ± 12.0% of students who took only an individual quiz before the exam (Figure 1).

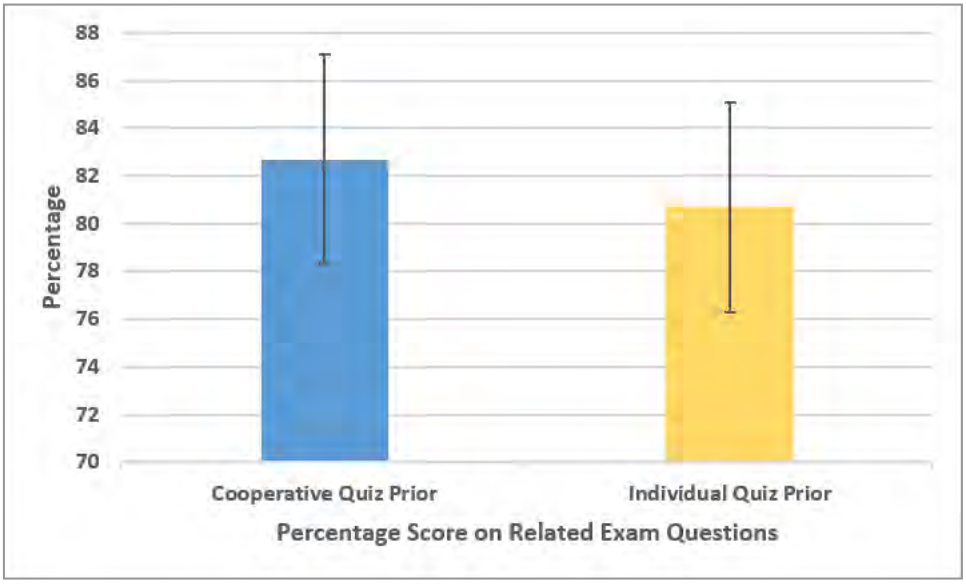

Figure 1. *Mean correct quiz-related exam questions, taking either a cooperative quiz (n=25) or an individual quiz (n=25) prior to the exam with 95% confidence intervals (6 students were excluded due to one or more missing exam grades).*

First-generation students earned significantly lower mean grades on quiz-related exam questions compared to continuing-generation status students regardless of whether they took a cooperative quiz or individual quiz only before the exam. First-generation students who took a cooperative quiz before the exam earned a mean grade of 74.6 ± 10.4% on quiz-related exam questions compared to a mean of 86.4 ± 12.2% by continuing-generation status students (independent samples t-test, t (17) = -2.137, p=0.047, with Cohen's d effect size = –1.016, 95% CI -2.075, 0.101). Note that the 95% confidence interval for this effect size includes 0, indicating that the magnitude of this effect should be interpreted with caution.

When taking an individual quiz only before the exam, first-generation students earned a mean grade of 74.1 ± 7.5% compared to a mean of 87.3 ± 12.2% earned by continuing-generation status students. Because the distribution of exam grades following individual-only quizzing was found to be non-normal (Shapiro-Wilk test, W=0.742, p<0.001), a Mann-Whitney test was used to compare first and continuing generation student exam grades. The results of this test were significant (U=9.5, p=0.026, rank biserial correlation=0.708), indicating that first-generation students tended to score lower than continuing-generation students on exams after individual quizzing. There were no significant gender differences found in the mean grades on quiz-related exam questions. For ethnicity, it was not possible to do a detailed comparison of grades because there were too few participants in ethnic categories other than White.

Student Anxiety Levels

Students were surveyed at the beginning and the end of the semester and asked to rate the level of anxiety that cooperative and individual quizzes caused them to feel on a scale from 1 (no anxiety) to 5 (extreme anxiety). In the pre-survey (n=22), the mean anxiety level reported by students for cooperative quizzes was 2.41 ± 1.26, while in the post-survey (n=14) the mean anxiety level was 2.50 ± 0.94. For individual quizzes, students reported a mean anxiety level of 2.27 ± 1.12 in the pre-survey and a mean anxiety level of 2.21 ± 1.05 in the post-survey. The mean anxiety levels did not

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change significantly between the pre- and post-surveys for either the cooperative quizzes or individual quizzes, and there was no significant difference in mean anxiety level reported by the students between the cooperative and individual quizzes (Figure 2).

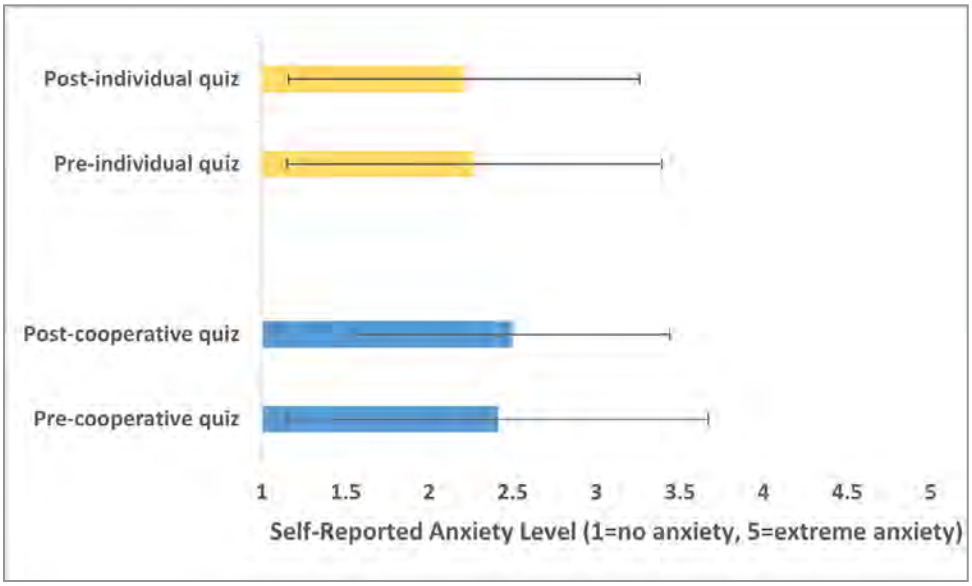

Figure 2. *Student anxiety level reported in the pre- (n=22) and post-surveys (n=14) with regard to individual and cooperative quizzes with 95% confidence intervals.*

Social anxiety levels were measured with the mini-SPIN questions on the pre- and post-surveys, and there were no significant gender (Table 3) or first-generation status (Table 4) differences. For ethnicity, it was not possible to do a detailed comparison because there were too few participants in ethnic categories other than White (Table 5).

	Pre-survey mini-SPIN Mean ± SD (n)	Post-survey mini-SPIN Mean ± SD (n)
Male	8.14 ± 2.67 (7)	17.20 ± 22.08 (5)
Female	7.85 ± 2.64 (13)	8.20 ± 2.97 (10)

Table 3. *Mean (± SD) scores on the mini-SPIN, used to assess social anxiety, based on gender reported at the beginning (pre) and end of term (post).*

	Pre-survey mini-SPIN Mean ± SD (n)	Post-survey mini-SPIN Mean ± SD (n)
First-generation students	8.63 ± 2.72 (8)	9.5 ± 2.08 (4)
Continuing-generation students	7.36 ± 2.58 (11)	11.90 ± 15.89 (10)

Table 4. *Mean (± SD) scores on the mini-SPIN, used to assess social anxiety, based on first- or continuing-generation status reported at the beginning (pre) and end of term (post).*

	Pre-survey mini-SPIN Mean ± SD (n)	Post-survey mini-SPIN Mean ± SD (n)
White	7.85 ± 2.70 (13)	13.3 ± 15.2 (10)
Asian	7.33 ± 1.53 (3)	6.50 ± 6.36 (2)
Hispanic	6.00 ± 3.21 (3)	9.50 ± 3.54 (2)
Black	9.67 (1)	3.00 (1)

Table 5. *Mean (± SD) scores on the mini-SPIN, used to assess social anxiety, based on ethnicity reported at the beginning (pre) and end of term (post).*

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Student Preference for Quiz Type

In response to the survey question, "Do you prefer to take in-class quizzes alone or in a group? Explain why.", students who left comments in both the pre- and post-surveys (n=13) were matched to determine if their quiz type preference had changed or stayed the same. Students whose preference remained positive for cooperative quizzes was 23.1% and students whose preference changed from individual quizzes to cooperative quizzes was also 23.1%. Students who preferred individual quizzes for the duration of the term was 23.1% and students whose preference changed from cooperative quizzes to individual quizzes was 15.4%. Two students (15.4%) remained indifferent for their preference of quiz type (Figure 3).

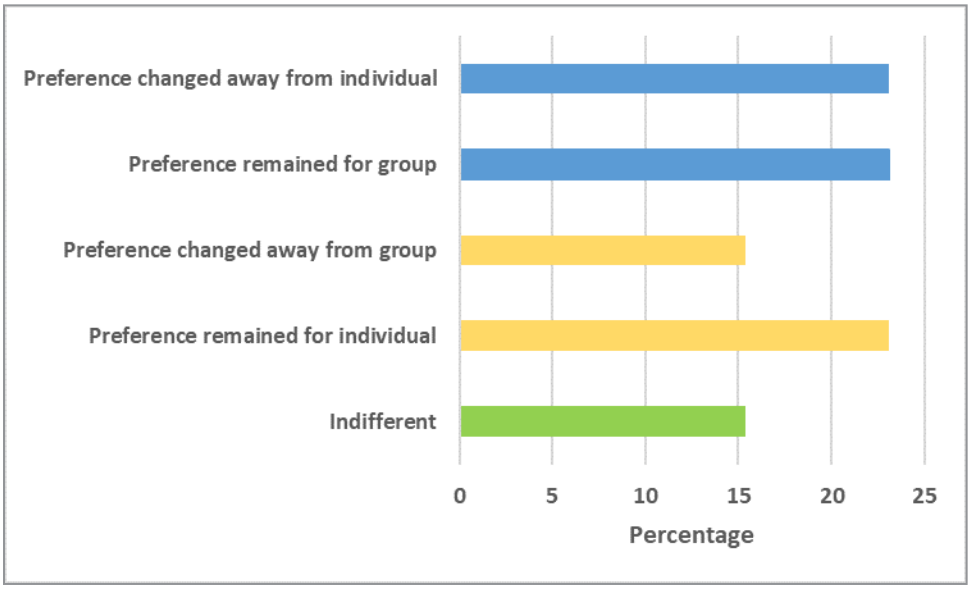

Figure 3. *Matched student comments (n=13) in the pre- and post-surveys regarding preference for quiz type.*

Discussion

The results of this research study showed that, although cooperative quizzes gave a small boost to the mean grade received on quiz-related exam questions, this was not statistically significant. This is in contrast to the findings of Jensen et al. (2002) who found that cooperative quizzes boosted academic performance. Our results may have been affected by the open book/note policy on quizzes and exams and by not using a proctoring program.

Consistent with previous research showing achievement gaps between first-generation and continuing-generation students (Hood et al. 2020), we also found that first-generation students had lower mean exam scores than continuing-generation students. Greater use of active learning strategies has been found to be a promising avenue to reduce this achievement gap for first-generation students (Eddy and Hogan 2014). The present study was not designed to specifically test the research questions with respect to first-generation student performance due to insufficient statistical power, and as such, no conclusions should be drawn from these data regarding the efficacy of cooperative quizzes for this demographic of students.

Student anxiety was also of interest in this study because active learning interventions that increase anxiety can decrease performance in a course (Hood et al. 2020). We found that, on average, students reported that cooperative quizzes induced little anxiety, and no significant difference in anxiety level was found between pre- and post-cooperative quiz use in this study. However, two students did report that cooperative quizzes caused them anxiety in the end of the semester survey. Only one of these students left a comment, saying that they preferred taking an individual quiz because they felt more relaxed. This could be one reason why the mean anxiety level students reported for cooperative quizzes increased slightly but not significantly from the beginning of the semester to the end of the semester. Interestingly, the mean anxiety level students reported for individual quizzes decreased slightly but not significantly over the same time

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period. We were expecting a decrease in anxiety, as students would likely feel more comfortable with quiz question types by the end of the semester.

Many students had never taken a cooperative quiz before, and some students changed their mind and preferred the cooperative quizzes after trying them. One student who decided that they liked cooperative quizzes better than individual quizzes explained that the *"group quiz allows the opportunity to think more completely and discuss concepts. Being able to explain it to someone else is the best way that I learn."* Another student who also liked cooperative quizzes explained that *"it helped to talk it out with other students."* An additional student said, *"It's good to take it alone first to see what you know and then collaborate with someone else."*

An interesting issue was seen by the instructor in one group during one of the cooperative quizzes. In this group, a student was talked out of the correct answer by the other two group members, which resulted in the student earning a combined quiz score that was lower than her individual quiz score. The student was frustrated but was determined to be a more forceful advocate for the answers she believed were correct on the next cooperative quiz and this did not happen to her again.

Limitations of this study include the small number of students in both sections, which decreased the statistical power of the study. Usually, this instructor's sections have 25-30 students in each, but enrollment at the college was lower than previous years due to the COVID-19 pandemic. An a priori power analysis should be done before this study is repeated with in-person classes to determine an appropriate sample size to obtain a more robust statistical power.

Another limitation was the lack of use of a proctoring program and allowance of the use of notes and the textbook with the quizzes and exams. This limitation will be resolved when the study is done with face-to-face classes because the instructor will be able to proctor the quizzes and exams, which will not be open book/notes. Another limitation of this study is that the survey instrument used was a composite of different surveys with some adaptations (e.g., the survey items from England et al. (2017) were modified). Changing the wording, number, or order of survey questions can change the validity and reliability of a questionnaire (O'Carroll et al. 2021). We did not test our composite survey's validity and reliability.

In the future, the intent is to repeat this study in face-to-face human physiology community college classes with a larger sample size and to also measure student anxiety in choosing versus assigning groups. We would also like to look more closely at how group structure affects anxiety by looking at the effect of placing first-generation students together and students belonging to the same minority group together.

Conclusions

Cooperative quizzes did not increase student anxiety and did not worsen student performance on exams. A large amount of research shows that cooperative quizzes help students learn, so they should be used as an active learning strategy in classes. It is also possible to use cooperative quizzes in synchronous broadcast classes by assigning students to breakout rooms.

Acknowledgments

We would like to thank Rose Hyson, PhD at the University of Minnesota, for help with preparation of this manuscript. We would also like to thank Kerry Hull and Murray Jensen for their guidance and support. This study was funded by a National Science Foundation grant: Community College Anatomy and Physiology Education Research (CAPER), Award #1829157.

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APPENDIX 1: STUDENT SURVEY

1. I consent / do not consent to participate in this research study.
2. What is your first and last name? (Please note that your name will be viewed by an independent third party, but not your instructor, and will be removed from all data prior to publication).
3. With which gender(s) do you identify?
   male, female, transgendered man, transgendered woman, genderqueer, nonbinary, other (please specify), or prefer not to say
4. Please indicate your ethnicity.
   White, Black or African American, Hispanic, American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, other (please specify), or prefer not to say
5. What is your estimated overall grade point average (GPA)?
6. Are you a first-generation college student (i.e., neither your parents nor your grandparents attended college)?
7. What grade (mark) do you expect to get in this class?
8. Evaluate the following classroom activities based on how much anxiety they cause you to feel.

Scale: 1 (no anxiety) to 5 (extreme anxiety) or prefer not to say

Listening/watching the instructor deliver a PowerPoint lecture

Working alone to answer a question using an anonymous personal response system (clicker) or an app (e.g., Top Hat, Socrative)

Working with another student to answer a question using an anonymous student response system (clicker) or an app (e.g., Top Hat, Socrative)

Volunteering to answer a question posed by the instructor

Being asked a question by the instructor without volunteering (cold calling)

Muddiest point assignments (indicating content items from a given lecture or chapter that were most difficult for you to comprehend)

Completing an in-class quiz alone that counts for less than 5% of the class grade (mark)

Completing an in-class quiz as a group that counts for less than 5% of the class grade (mark)

Taking quizzes for credit out of class (e.g., Canvas)

Working in a small group to complete an activity that is not submitted for grades (marks)

Working alone to complete an activity that is not submitted for grades (marks)

Choosing your own group for the in-class group quiz

Being assigned to a group for the in-class group quiz by the instructor

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9. Evaluate the following classroom activities in terms of how much they contribute to your learning.

Scale: 1 (no anxiety) to 5 (extreme anxiety) or prefer not to say

Listening/watching the instructor deliver a PowerPoint lecture

Working alone to answer a question using an anonymous personal response system (clicker) or an app (e.g., Top Hat, Socrative)

Working with another student to answer a question using an anonymous student response system (clicker) or an app (e.g., Top Hat, Socrative)

Volunteering to answer a question posed by the instructor

Being asked a question by the instructor without volunteering (cold calling)

Muddiest point assignments (indicating content items from a given lecture or chapter that were most difficult for you to comprehend)

Completing an in-class quiz alone that counts for less than 5% of the class grade (mark)

Completing an in-class quiz as a group that counts for less than 5% of the class grade (mark)

Taking quizzes for credit out of class (e.g., Canvas)

Working in a small group to complete an activity that is not submitted for grades (marks)

Working alone to complete an activity that is not submitted for grades (marks)

10. For the activities that you found helpful, please explain why they were helpful. Did they help you develop more effective study strategies? If so, what were those strategies?

11. Do you prefer to take in-class quizzes alone or in a group? Explain why.

12. When taking in-class quizzes as a group, do you prefer choosing your own group or having the instructor assign the group? Explain why.

13. STAI-6 questions (n=6). Copyrighted and cannot be reproduced here.

14. Mini-SPIN questions (n=3). Copyrighted and cannot be reproduced here.

15. These items deal with ways you've been coping with the stress in your life since you started college. Obviously, different people deal with things in different ways, but I'm interested in how you've tried to deal with challenges. Each item says something about a particular way of coping. I want to know to what extent you've been doing what the item says - how much or how frequently. Don't answer on the basis of whether the strategy seems to be working or not—just whether or not you're doing it. Use these response choices. Try to rate each item separately in your mind from the others. Make your answers as true FOR YOU as you can.

Scale: (1) I haven't been doing this at all; (2) I've been doing this a little bit; (3) I've been doing this a medium amount; (4) I've been doing this a lot

I've been turning to work or other activities to take my mind off things.

I've been concentrating my efforts on doing something about the situation I'm in.

I've been taking action to try to make the situation better.

I've been getting help and advice from other people.

I've been criticizing myself.

I've been trying to come up with a strategy about what to do.

I've been doing something to think about it less, such as going to movies, watching TV, reading, daydreaming, sleeping, or shopping.

I've been trying to get advice or help from other people about what to do.

I've been thinking hard about what steps to take.

I've been blaming myself for things that happened.

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16. Please evaluate the following statements the best you can.

Scale: Strongly Disagree (1) to Strongly Agree (7)

I am confident that I can achieve good exam results if I really put my mind to it.

If I don't understand an academic problem, I persevere until I do.

When I hear of others who have failed their exams, this makes me all the more determined to succeed.

I am confident that I will be adequately prepared for the exams by the time they come around.

I tend to put off trying to master difficult academic problems whenever they arise.

No matter how hard I try, I can't seem to come to terms with many of the issues in my academic curriculum.

I am convinced that I will eventually master those items in my academic course which I do not currently understand.

I expect to give a good account of myself in my end-of-semester exams.

I fear that I may do poorly in my end-of-semester exams.

I have no serious doubts about my own ability to perform successfully on my exams.

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