Implementation of a Group Quiz Format in an Introductory Meat Science Course

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Abstract

Collaborative learning methods are increasing in popularity as a way of improving student performance and involvement in undergraduate courses. For this study, a group quiz format was used in an attempt to improve course grades and engagement in an introductory meat science course. Six group quizzes and six individual quizzes were taken by 70 students during two semesters of the course. For group quizzes, students were randomly assigned to groups of three to four students and given ten minutes to complete the quiz individually followed by three minutes to discuss the quiz and change answers. At the end of the semester, students completed a Likert item questionnaire concerning their opinions on the quiz format. The average scores were not different between the two quiz types in both semesters. Group quizzes also did not improve exam scores or overall course grades for the students. Even though average performance was not improved, students highly preferred the group quizzes to the individual quizzes and valued the exercise.

Keywords: group quiz, student engagement, meat science

Collaborative learning, or student group learning, has long been used in classrooms across multiple disciplines as a supplement to traditional lecturing methods (Gaudet et al., 2010; Petrunich- Rutherford & Daniel, 2019). When done in groups, classroom activities like semester projects, worksheets, and quizzes can be designed to increase overall student involvement by requiring peer interaction in a structured manner. The assumed value of these exercises stems from the ability of more knowledgeable or more prepared students to positively influence less knowledgeable or less prepared students through the duration of the group work (Ewald, 2005). Proponents for these types of structured group exercises often use the Theory of the Zone of Proximal Development (Vygotsky, 1978; Morgan et al., 2007) as support for improved learning outcomes. The ability of collaborative learning exercises to directly lead to improved performance on graded class materials like exams seems to be course and instructor dependent. However, it is clear that students overwhelmingly prefer in-class group work that is designed appropriately with clearly communicated reasoning for why the exercise is used over traditional lecturing (Bayles, 2020; Herring et al., 2022;

Martins et al., 2021).

Group assessments like quizzes or exams have the potential to significantly contribute to improving student learning and engagement. In large classes, splitting individuals into groups to take closed-book assessments may improve learning by creating opportunities for students to actively work through questions and debate possible answers in their groups. The process of debating what is correct adds an active component to the learning process that may not exist in an otherwise traditional classroom relying on passive learning (Morgan et al., 2007). Inherent to using assessments in this way is the risk of getting a question wrong. Maintaining this risk by making the assessments closed book and graded may help keep students invested in participating and reinforcing the value of learning the material presented (Goodhead & MacMillan, 2019). Group quizzes are also said to decrease the test anxiety experienced by some students and to increase positive interactions in the class (Morgan et al., 2007; Martins et al., 2021). The community that is built around group assessments also encourages students to openly collaborate with other aspects of the class (Bayles, 2020).

Improving classroom engagement and performance is a constant concern for instructors, and these concerns were heightened due to the struggles associated with teaching during the Covid-19 pandemic. Significant decreases in student performance and engagement occurred in college classes during the initial semesters of the pandemic. While there are a multitude of possible explanations that could explain the drop in performance, it was thought that virtual and hybrid classrooms were not an improvement to in-person classrooms for students. Upon returning to in-person classrooms, increased student collaboration was implemented for the introductory meat science course in our department in an effort to regain some of the lost community and performance that resulted from not teaching in person. Group quizzes were chosen as the collaborative learning method for this study due to the potential for social and learning improvements. Group quizzes were also chosen because they were able to be easily implemented into the course that was chosen for the study. This course already employed the use of online quizzes and had a unit structure that was intuitive for conducting the study. Our objective was to improve grades of exams taken individually in the introductory meat science course by employing an in-person group quiz format. We hypothesized that group quiz scores would be higher than individual quiz scores and that exam scores from units where group quizzes were used would be higher than exam scores where individual quizzes were used.

Methods

Class Description

The project was certified as exempt under project number 20211121483EX by the University of Nebraska – Lincoln Institutional Review Board. It was conducted in Animal Science 210: Animal Products course during the fall 2021 and spring 2022 semesters. Forty-two students were enrolled in the fall semester and 28 students in the spring semester. The course was split into four units, each unit contained three ten-point quizzes and one non-cumulative exam. Students enrolled in the Meat Science option, the Food Animal Production and Management option, and the Veterinary Animal Science option are required to take the course in order to complete their degree in Animal Science. The lesson structure for both semesters followed a similar pattern (Table 1). However, conflicts with facility scheduling meant that content covered within each unit was not identical between the two semesters. Lessons were delivered primarily using direction instruction methods using a combination of power point slides and in-person demonstrations in the university meat production facility. Group quizzes were given in the first and third units, and individual quizzes were given in the second and fourth units. For group quizzes, students were randomly assigned to groups of three to four and were given approximately ten minutes to complete the quiz individually followed by three minutes of discussion where answers could be changed. Each individual completed their own quiz during the group quiz units with grades reported individually for each student. The same groups were used for all three quizzes in unit one, and new groups were assigned to complete all quizzes in unit three. Students were not given time to discuss or change answers during individual quizzes.

Grade Analysis

A paired t-test was conducted with SAS 9.4 to compare score averages between group quizzes and individual quizzes and to compare exams scores from units one and three to units two and four. Quizzes that were not attempted were given a score of zero and were excluded from the analysis. No quiz that was attempted received a score of zero. An average of 7 quizzes and 3 quizzes were not attempted for each quiz in the fall and spring semesters, respectively. The group quiz – individual quiz differential was calculated by subtracting the average score of completed group quizzes from the average score of completed individual quizzes for each student. One exam was not attempted due to a student dropping the course. Grades between the two semesters were not analyzed together because the course schedule and content were not identical between the fall and spring.

Questionnaire

An anonymous questionnaire was delivered to the students after the final quiz each semester to determine students' perception of the group quiz format compared to individual quizzes. The questionnaire was reviewed and edited by the research team and by the Institutional Review Board. It contained a multiple choice question, Likert items with a five point scale, and open response questions (Table 2). Prior to receiving the questionnaire, students who were eligible and who volunteered to participate signed a consent form. Upon completing the questionnaire, students were given ten bonus points towards their final grade. Students who were not eligible or who did not volunteer to complete

Table 1.

Course content for Animal Science 210: Animal Products course during the fall 2021 and spring 2022 semesters. Note: Each unit contained three quizzes and one exam. All exams were taken individually.

	Fall 2021 Content	Spring 2022 Content
Unit 1: Group quizzes	• Introduction and history of meat products • Muscle structure and contraction • Conversion of muscle to meat • Anatomy of food animal species	• Introduction and history of meat products • Muscle structure and contraction • Conversion of muscle to meat • Anatomy of food animal species
Unit 2: Individual quizzes	• Inspection and grading • Swine slaughter and pork carcass fabrication • Meat preservation	• Inspection and grading • Swine slaughter and pork carcass fabrication • Meat preservation • Cured meat production
Unit 3: Group quizzes	• Cured meat production • Poultry products • Beef slaughter and fabrication	• Poultry products • Beef slaughter and fabrication
Unit 4: Individual quizzes	• Lamb slaughter and fabrication • Milk products • Meat cookery and human nutrition	• Lamb slaughter and fabrication • Milk products • Meat cookery and human nutrition

Table 2.

Likert item questionnaire.

Question 1	This class is (circle one): Required for my major or an elective class.
Question 2	I studied the same amount of time for individual quizzes compared to group quizzes.
Question 3	In my opinion, each group member in my groups was equally prepared for group quizzes.
Question 4	I valued discussing quiz problems with my group members during group quizzes.
Question 5	I got higher scores on individual quizzes than group quizzes.
Question 6	Changing my answers during the discussion time of group quizzes improved my quiz scores.
Question 7	Taking group quizzes helped me to better understand the material.
Question 8	Taking individual quizzes helped me to better understand the material.
Question 9	Taking group quizzes helped the other members of my group to better understand the material.
Question 10	I would prefer to take all quizzes with the individual format.
Question 11	I would prefer to take exams in this course with the group format.
Question 12	Referring to your answer to Q10, why do you have this preference?
Question 13	Referring to your answer to Q11, why do you have this preference?

Note. Possible responses were: Strongly Disagree, Disagree, Neither Agree or Disagree, Agree, Strongly Agree. Bolded questions were not Likert items.

the questionnaire were given a short writing assignment to also receive ten bonus points. Responses were tabulated for each Likert item as a percentage of the chosen response, and written responses to open-ended questions were transcribed into Microsoft Excel and clustered based on similar themes. Questionnaire responses from both semesters were combined, and further statistical analysis of the questionnaire responses was not conducted.

Results and Discussion

Student Performance

Results from the current study support the claim that impact of group quizzes on the student performance is minimal. In the fall semester, the average scores between quizzes (P = 0.79) and exams (P = 0.27) were not statistically

different. Group quizzes averaged 8.8 of 10 points, and individual quizzes averaged 8.7 of 10 points (Table 3). Exams from group units averaged 77.4 of 100 points, and exams from individual units averaged 77.5 of 100 points (Table 4). For the spring semester, the average quiz scores between the group and individual quizzes were separated by only 0.4 points and were not significantly different (P = 0.62). When comparing the average scores of group and individual quizzes per student across both semesters, the scores for 57 students between the two quiz types were different by less than one point (Figure 1). Two students scored better on individual quizzes by greater than one point, and eleven students scored better on group quizzes by greater than one point. Interestingly, the exams from group quiz units in the spring semester were higher than exams from individual units by 2.5 points. Although this difference is significant (P = 0.009), it may not be indicative of an overall improvement in learning by the students in the spring semester, because the average exam scores were lower in all spring semester exams compared to the fall semester. Overall, concerns from faculty that adding group work could artificially inflate the course grades is not supported by the data generated from the current study.

Table 3.

Average quiz scores and comparison of average scores between group and individual quizzes.

Quiz, Type	Fall (n)	Spring (n)
Quiz 1 (Group)	9.2 (39)	8.7 (28)
Quiz 2 (Group)	8.8 (32)	7.6 (25)
Quiz 3 (Group)	8.7 (40)	9.0 (26)
Quiz 4 (Individual)	8.7 (35)	8.3 (24)
Quiz 5 (Individual)	9.3 (39)	8.8 (24)
Quiz 6 (Individual)	8.2 (19)	7.0 (26)
Quiz 7 (Group)	8.5 (37)	8.3 (26)
Quiz 8 (Group)	8.1 (29)	9.8 (24)
Quiz 9 (Group)	9.0 (40)	8.9 (25)
Quiz 10 (Individual)	9.2 (37)	9.4 (24)
Quiz 11 (Individual)	8.7 (24)	7.4 (23)
Quiz 12 (Individual)	8.9 (41)	9.2 (24)
Group Average	8.8 (217)	8.7 (154)
Individual Average	8.7 (195)	8.3 (145)
P-value	0.79	0.62

Note. Incomplete quizzes were given a score of zero and were excluded from the analysis. Ten points were available per quiz.

Table 4.

Comparison of average scores between exams from group and individual quiz units.

Exam (Unit Type)	Fall	Spring
Exam 1 (Group)	77.1	69.4
Exam 2 (Individual)	75	70.6
Exam 3 (Group)	77.8	74.9
Exam 4 (Individual)	80	68.8
Average Group Unit Score (n)	77.4 (84)	72.2 (56)
Average Individual Unit Score (n)	77.5 (84)	69.7 (55)
P-value	0.27	0.009

Note. One exam was not completed. 100 points were available per exam.

The ability of collaborative assessments to cause improvements in the scores of quizzes, exams, and final grades is not unanimously agreed upon, and recent studies focusing on this type of active learning exercise have yielded mixed results. In an upper-level psychology course, Petrunich-Rutherford & Daniel (2019) reported that students enrolled in a section that used collaborative quizzes scored better on quizzes and had slightly higher overall course scores compared to students in a section that did not use collaborative quizzes. However, the exam scores and pass/fail rates between the two course sections were not different, and the authors stated that the small improvement in overall course grades may have been due to differences in individual student performance rather than an actual improvement in the course section as a whole. Herring et al. (2022) conducted a similar study in a first year organic chemistry course that included units with either group quizzes or individual quizzes followed by an exam at the end of the unit. Score averages were not different between group and individual quizzes and between exam scores from group and individual quiz units. For a biological history course with ten students, Martins et al. (2021) employed more comprehensive group work throughout the course compared to the studies mentioned above. The course utilized multiple methods of in-class discussion, group quizzes, and group exams. There were not individual quizzes included in the course, but the exams were first completed individually by each student and then taken again in small groups. Retaking the exams in groups resulted in a 12% increase in the exam score compared to score of the individual exam with multiple students achieving increases greater than 20% on the group exam.

Student Perceptions

A total of 61 students (87%) completed the entire questionnaire, and one student only completed the front page of the questionnaire. Of the students who completed the questionnaire, 75% required the class as a part of their major. Students believed that both the group and individual quizzes helped them to better understand the course material

with a combined agree and strongly agree percentage of 80.7% and 90.3% for questionnaire questions six and seven, respectively (Figure 2). Some students believed that they performed better on group quizzes than individual quizzes. In response to questionnaire question four, 38.7% of students either disagreed or strongly disagreed that they got higher scores on individual quizzes, while 45.2% of students said that they neither agreed or disagreed and 16.2% said they agreed or strongly agreed in response to this question. This range of responses is consistent with the average differential between the two quiz types (Figure 1). Even though the quiz type had very little effect on actual performance, students overwhelmingly preferred the group quizzes with 93.5% of students agreeing or strongly agreeing that they valued discussing the questions during group quizzes. In response to question nine, 83.6% of students believed that the group quizzes helped the other members of their group to understand the material, and 73.8% of students said they would not prefer to take all of the quizzes with the individual format (question 10). Group exams were not used in this course, but 77% of students said they would prefer the group quiz format on exams (question 11). Some students disagreed (13.1%) in response to this question, but no students strongly disagreed. The response to the open ended questions (questions 12 and 13) reflected similar pattern to the Likert items discussed above. One student stated, "I was indifferent, I always like doing things on my own but I saw the value in group work." Another said, "I think it's beneficial to bounce ideas off one another. If you can help someone understand the material, you're more likely to remember it." One student said that they preferred to take exams on their own, but another said "When working in the workplace, you won't work alone so the group aspect will be helpful in the future." Lastly, a student said, "Group quizzes are one of the only ways we interact as a group in this class and it allows us to meet new people." The sentiments

Figure 1.

Average difference between group quiz scores and individual quiz scores for each student (n=70)

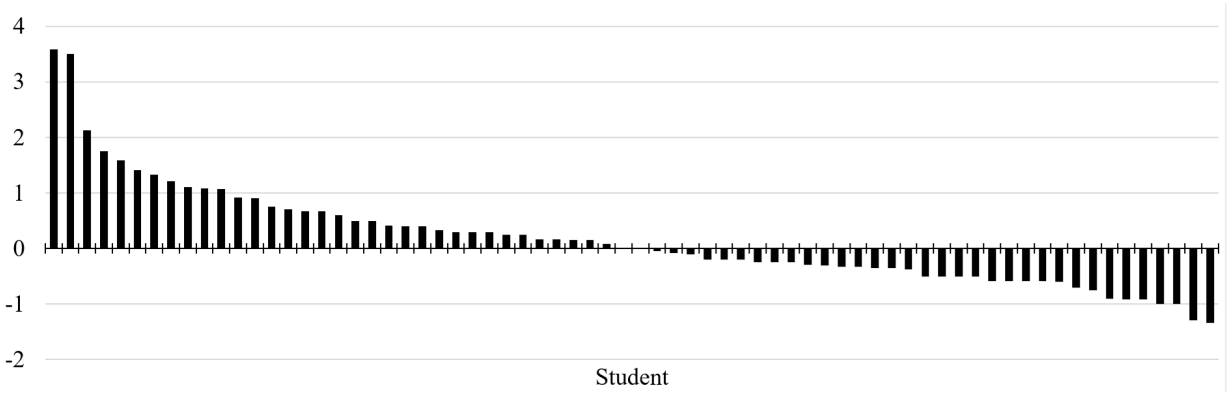
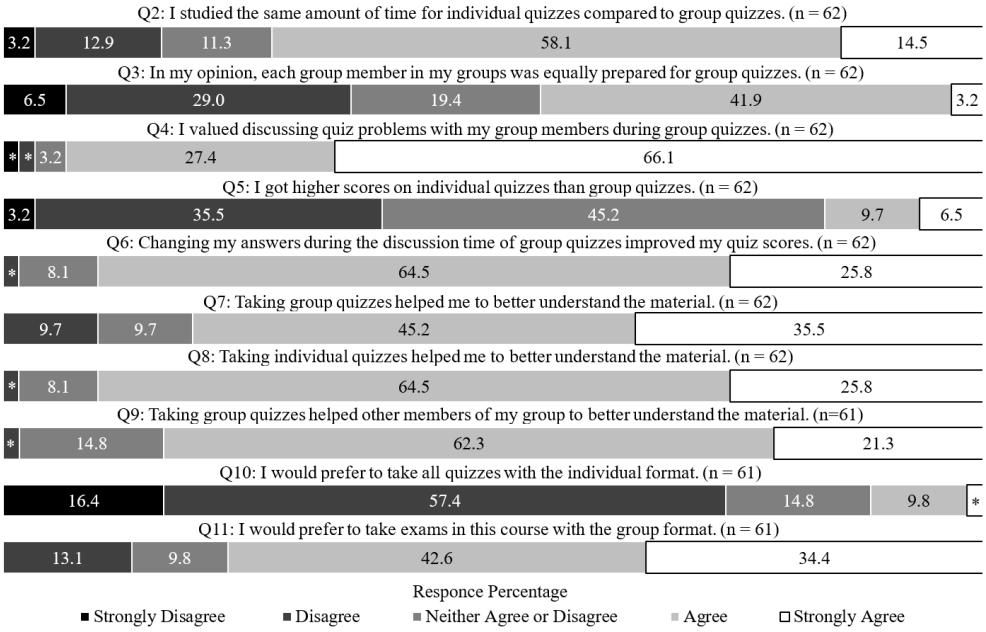


Figure 2.

*Likert scale responses to questionnaire items reported as a percentage. * = 1.6%*



expressed by students in this study are consistent with other studies using similar group work methods despite the differences between the courses. (Bayles, 2020; Herring et al., 2022; Martins et al., 2021). Overall, surveys of students who have participated in courses that utilize group assessments have overwhelmingly reported that students value working in groups.

Summary

The two quiz methods did not impact the performance of the class as a whole, although using the group quiz format did improve the average quiz score by more than two points for a few students. For instructors who are concerned over group quizzes resulting in inflated course grades, the averages of individual and group quizzes not being different from each other can be used as evidence that grades would remain similar. Additionally, the group quizzes were preferred by the large majority of students in this class. They valued the discussion time associated with the group quizzes and believed the group quizzes to be beneficial for their group members. Incorporating this small amount of collaborative work into a course that previously did not utilize any collaboration became a valuable part of the classroom community that increased engagement and benefited the students in the social aspects of participating in a class.

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