

Are Classical Assessments Offering Adequate Insight into Post-Pandemic Teaching Methods?



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Abstract

Educators must continuously assess and adjust to maximize the amount of information students retain. One way to evaluate teaching effectiveness is thru pre- and post-semester assessments. Factors such as individual willingness to participate can affect the validity of these assessments. Our hypothesis was that students will more actively participate in a group activity compared with written pre- and post-semester assessments. In this study, we evaluated 3 different types of pre- and post-assessments to assess knowledge retention and participation. Participation decreased as the semester progressed resulting in only 31 of 57 students who completed all 6 of the assessments. There was an interaction ($p < 0.001$) between the type (individual, team, or activity) and time of assessment. The percentage of correct answers increased ($p < 0.001$) between pre-semester (average 32.92 ± 1.58) and post-semester assessments (average 47.54 ± 1.58). There was a

correlation ($p = 0.04$) between the final course grade and the post-semester individual written assessment. In conclusion, participation throughout the semester is a major issue in assessing teaching quality and knowledge retention and the utilization of group activities does not appear to impact that participation. However, the best assessment for knowledge learned remains the classical written individual assessment.

Keywords: student participation, group activity, assessment type, post-pandemic

Efficient teaching requires educators to frequently analyze and understand the progress students have made and make adjustments, as needed, to maximize the information learned and retained (Fisher & Bandy, 2019). Additionally, critical reflection on teaching pedagogy is vital for the development and growth of an educator (Brookfield, 1996). One way to reflect on teaching effectiveness is via

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student learning assessments (Fisher & Bandy, 2019). Assessment serves as a communicative bridge between the world of education and society (Broadfoot & Black, 2004). Learning assessments function like magnifying glasses to elucidate if the transfer of information between teacher and student has been successful. Learning assessments can vary from classical pen and paper exams to group activities that involve voluntary participation. The different types of assessments can lead to varying results based on individual knowledge levels, experience, and learning styles (Fisher & Bandy, 2019). Overall, assessments can be split into two categories: summative and formative. A summative assessment tends to be more comprehensive, focused on learning outcomes, and generally has little to no feedback (Maki, 2002). A formative assessment tends to be more intermediary to aid in the learning process with both positive and negative feedback given to the students (Maki, 2002). Student success can be defined in a multitude of ways depending on the type of class, level of the student, and type of information. To effectively evaluate success, a variety of assessments utilized in different capacities is a must.

Pre- and post-assessments are, generally, used to gauge an individual student's progression and retention of knowledge about a given subject over a given amount of time (Wiggins & McTighe, 2005). This can be useful for an instructor to gauge the effectiveness of teaching over the duration of a course, whether that be a semester, a quarter, or another period of time (Wiggins & McTighe, 2005). However, there is much debate on whether this is an effective tool to truly determine the knowledge retention of students. Factors that can affect the efficacy and validity of these assessments include the type of course, the subject being taught, or the willingness of individuals to actively participate (Wiggins & McTighe, 2005).

In the past two decades, technology has significantly impacted the tools available and utilized in education (Eiland & Todd, 2019). Students in the current generation even expect a moderate amount of technology to be used in courses (Monaghan et al., 2011; Oylar et al., 2016). The implementation and incorporation of online content were greatly increased due to the COVID-19 pandemic. Now more than ever, students are more comfortable with virtual lectures and group assignments (Rapanta et al., 2021). This raises questions about the best way to reach and engage learners who were exposed to technologies in learning at such a young age. Various factors influence student engagement and how individuals perceive classroom participation. Individual confidence significantly affects the evaluation of knowledge. Previous research studies have indicated that confidence is a motivating factor in their level of participation (Rocca, 2010). This can affect results in assessments if individuals are not willing to trust their own knowledge. Class size can also prove an intimidating barrier to some students (Rocca, 2010), where larger class sizes may discourage students from contributing to discussions or give the idea that not everyone's ideas are necessary. Another proven barrier is how professors and students perceive the definition of participation. In a 2005 study, instructors rate individual student participation while

students were required to rate their own participation within a given scale over a six-week period (Dancer & Kamvounias, 2005). The study found that students rated their participation higher than their instructors, which supports the idea that the perception of effective participation can differ between individuals.

Adjusting teaching styles and techniques to the needs and customs of the current student perspective is crucial to evaluating student knowledge and teaching success. In this study, we evaluated 3 different types of pre- and post-assessments to observe knowledge retention and the student's willingness to participate or answer questions in different environments. We hypothesized that students would more actively participate in a group setting compared with the classical pre- and post-semester individual assessment resulting in a more accurate representation of knowledge.

Materials and Methods

The course by which all of this information was acquired is a junior- and senior-level course. This is a required course for all Animal Science majors and an elective for Biochemistry and Cellular and Molecular Biology majors. The course covers reproductive and lactation anatomy and physiology in livestock, companion animals, and humans with avian and exotic animal species discussed for comparison. The course has been taught by this instructor every spring for the past 4 years. The semester in which is data was acquired had 57 students enrolled.

The first week of class (second meeting time) all individuals present were given 15 minutes to complete a classical pre-knowledge written assessment with 14 questions covering critical material that would be covered in class. Of the students enrolled, 52 individuals completed the classical pre-knowledge individual assessment. During the first lab period (third meeting time), students were randomly assigned upon entry into the classroom into 13 groups (four to five individuals per group). Groups were given the same classical paper assessment and were allowed to complete it together instead of individually. The written assessment questions were a subset of questions pulled directly from a larger bank used for the group activity. After the classical assessment, groups participated in a trivia/knowledge activity. Of the students enrolled, 55 individuals completed the classical pre-knowledge group written assessment and group activity (Table 1). However, only 52 individuals completed all three pre-semester knowledge assessments (Table 1).

The last full week of class for the semester, all individuals present in class were given 15 minutes to complete the same classical written assessment as a post-semester knowledge quiz containing the same 14 questions previously used on the pre-semester written assessment. Of the students enrolled, 40 individuals completed the classical post-knowledge individual assessment (Table 1). During the final lab period, students were placed back into the same 13 groups from the beginning of the semester. However, due to a lack of participation at the end of the semester (43 students vs 55 students), if a group only

Table 1.

The number of students that participated in a given assessment over the course of a semester.

Category	Pre-Semester Assessments	Post Semester Assessments
Individual	52/57	40/57
Group	55/57	43/57
Both ¹	52/57	32/57
All assessments ²	31/57	

Note. ¹Individuals in this category participated in all of the assessments (individual, team, and activity) during either the beginning or end of the semester.

²Individuals in this category participated in all of the assessments (individual, team, and activity) both at the beginning and end of the semester.

had 1 individual show up, that group was dissolved (n = 3) and the individual was added to another small group to maintain group sizes (four to seven individuals per group). Groups were given the same classical paper assessment and allowed to complete it together instead of individually. After the written assessment, groups participated in a trivia/knowledge activity. Of the students enrolled, only 32 individuals completed all three post-semester knowledge assessments and only 31 individuals completed all six knowledge assessments (Table 1). There were no points (bonus or required) assigned to the written assessments but there were bonus points given during the group activity.

Statistical Analyses

Data collected from the pre- and post-semester knowledge assessments were utilized to determine if classical (written and individual) methods provide better, worse, or the same information as group written or group activity assessments by current college students. Differences were determined for the main effects of timing (pre- vs. post) and assessment type (individual written, group written, and group activity), as well as the interaction for scores, were determined via PROC GLIMMIX in SAS 9.4 (SAS Institute, Cary NC). While the classical (written assessment) had the same number of questions (14 questions) for all four assessments, the group activity did not have the exact same number of questions due to time constraints (66 questions pre-semester vs 54 questions post-semester). Therefore, all data were adjusted to percentages to account for the question number differences. To further elucidate the full impacts of these results, a comparison of the final grade at the completion of the course compared with participation in assessments was analyzed via PROC GLIMMIX. Finally, PROC CORR was utilized to determine if final grades and assessment outcomes were correlated. Differences between means were found when $p < 0.05$ and a tendency was stated with $p < 0.10$.

In accordance with our hypothesis that students will actively participate more readily in a group setting compared with the classical written pre- and post-semester individual assessment would result in a more accurate representation of knowledge. The results discussed herein show that the assessment type may not be the largest hindrance to adequate pre- and post-assessment but merely student participation. In Table 1, participation early in the semester was high (52 out of 57 students), but as the semester progressed, participation and attendance decreased dramatically (32 out of 57 students).

This resulted in only 31 of 57 students completing all 6 of the knowledge assessments throughout the semester. Attendance was not mandatory in this course and students were aware of when the assessment or group activity was going to be part of the daily agenda. The type of assessment did not impact the level of participation (Table 1). As discussed earlier, adequate participation is perceived differently among individuals, but these perceptions have been heavily influenced by circumstances presented by the COVID-19 pandemic (Hews et al., 2022). The students in this study have experienced most of their college career either online or through hybrid learning and changes in motivation seem to be a consistent factor in students that are transitioning back to the face-to-face classroom (Hews et al., 2022). In many cases, class expectations changed with more open-note assessments and assignments. While this is perceived as an easier option for some, overall, students have had a more negative experience with online learning and claimed to be less motivated than when the course was face-to-face (Rapanta et al., 2021). Student engagement was also heavily impacted by the external stressors each individual was experiencing which may have changed during the pandemic and may still affect performance post-pandemic (Hews et al., 2022).

There was an interaction ($p < 0.001$) between the type of assessment (individual, team, or activity) and the time of assessment (pre- vs post-). As would be expected, the percentage of correct answers increased ($p < 0.001$) between pre-semester (average 32.92 ± 1.58) and post-semester assessments (average 47.54 ± 1.58). The only assessment type that decreased between pre- and post- was the group activity with pre-semester having $59.58 \pm 1.58\%$ correct compared with $41.40 \pm 1.58\%$ correct. The percentage of incorrect and not answered questions (Table 2) also decreased ($p < 0.001$) for all assessment types from pre-semester (average $67.08 \pm 1.58\%$ and $25.87 \pm 2.14\%$, respectively) and post-semester (average $52.46 \pm 1.58\%$ and $4.04 \pm 2.14\%$, respectively). These results do indicate that knowledge increased over the course of the semester. However, the percentage of incorrect answers increased in the group activity from the beginning of the semester to the end with pre-semester having $40.42 \pm 1.58\%$ incorrect compared with $58.60 \pm 1.58\%$ incorrect. Interestingly, the results also indicate that type of assessment may influence the quality of data acquired dependent on the time at which the assessment is given to the students. The students are much more willing to make an “educated guess” at the end

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Table 2.

Comparison of answers (%) within each type of assessment over the course of an entire semester to determine if one type of assessment is better than another.

Answer Type	Pre-Semester Assessments			Post Semester Assessments			S.E.M.	p value
	Individual	Team	Activity	Individual	Team	Activity		
Correct	12.19 ^d	26.98 ^c	59.58 ^a	38.78 ^b	62.45 ^a	41.40 ^b	1.58	< 0.001
Incorrect	87.81 ^a	73.02 ^b	40.42 ^d	61.23 ^c	37.55 ^d	58.60 ^c	1.58	< 0.001
Blank ¹	42.73 ^a	30.38 ^b	4.49 ^{cd}	8.68 ^c	2.33 ^d	1.12 ^d	2.14	< 0.001

Note. ¹Blank answers were also included in the values reported as incorrect data
^{a,b,c,d} Means with different superscripts differ by $p < 0.05$

Table 3.

End of semester grades associated with individuals who did or did not participate within a given assessment category.

Category	No		Yes		S.E.M.	p value
	Pre ¹	Post ²	Pre ¹	Post ²		
Individual	76.2	73.3	77.4	79.0	3.47	0.56
Group	84.1	72.4	77.1	78.9	4.42	0.22
Both ³	76.2	74.2	77.4	79.8	3.38	0.56
All assessments ⁴	74.4		79.8		2.62	0.15
Overall Class Average			78.2		13.9	---

Note. ¹Assessment was given to the student at the beginning of the semester

²Assessment was given to the student at the end of the semester

³Individuals in this category participated in all of the assessments (individual, team, and activity) during either the beginning or end of the semester.

⁴Individuals in this category participated in all of the assessments (individual, team, and activity) both in the beginning and end of the semester.

of the semester, which may help to explain the decrease in blank and correct answers at the end of the semester. Additionally, the students appeared to be more willing to simply leave an answer blank for individual and group written assessments compared to the activity, especially at the beginning of the semester. Therefore, we believe a group activity at the beginning of the semester and a written, specifically individual, assessment at the end of the semester would result in the highest quality of data returned for knowledge assessments.

The decrease in participation lead to the hypothesis that students with higher grades did not attend the class for the post-semester group activity. However, we found no differences ($p > 0.15$) in final grades for any of the assessments or time of assessment participation (ranges 72.4 to 84.1). The overall course average was 78.2 ± 13.9 , which is in line with previous semesters. To further elucidate if students who performed better in the class altered the information gained from the pre- and post-semester assessment, correlation analyses were conducted. There were correlations between final course grade and correct and incorrect answers for the post-semester individual written assessments ($p = 0.04$) and tended to have correlations for the pre-semester team written ($p = 0.10$),

and pre-semester group activity ($p = 0.08$). The percentage of correct answers on the individual written assessment conducted at the end of the semester was positively correlated (0.32) with the final grade ($p = 0.04$). The inverse was true with the percentage of incorrect answers found to be negatively correlated (-0.32) with the final grade ($p = 0.04$; Table 4). This suggests that students who performed better throughout the semester retained the information and performed better on the post-semester assessment. The percentage of correct answers on the pre-semester team written assessment ($p = 0.10$) and group activity ($p = 0.08$) tended to be negatively correlated (-0.23 and -0.23, respectively) with the final grade. However, the percentage of incorrect answers tended to be positively correlated (0.23) for both the pre-semester team written assessment ($p = 0.10$) and group activity ($p = 0.08$) with the final grade (Table 4). These results are intriguing and may further support that students who end with a higher final grade are more willing to make an “educated guess” and rely on their previously gained knowledge early in the semester. Student motivation to participate is certainly increased when their grade is directly dependent on it (Dallimore et al., 2006). When participation is voluntary and does not numerically impact individual grades, students tend to be

Table 4.

The correlation of final grade with the percentage of answers by type for a given individual.

Time of Assessment	Type of Assessment	Answer Type	Correlation Coefficient	p value	
Pre-semester	Individual	Correct	0.12	0.38	
		Incorrect	-0.12	0.38	
		Blank ¹	0.01	0.95	
	Team	Group Activity	Correct	-0.23	0.10
			Incorrect	0.23	0.10
			Blank	0.10	0.49
		Individual	Correct	-0.23	0.08
			Incorrect	0.23	0.08
			Blank	-0.05	0.72
Post-semester	Team	Correct	0.32	0.04	
		Incorrect	-0.32	0.04	
		Blank	-0.05	0.76	
	Group Activity	Team	Correct	0.10	0.51
			Incorrect	-0.10	0.51
			Blank	-0.26	0.87
		Individual	Correct	-0.03	0.87
			Incorrect	0.03	0.87
			Blank	-0.11	0.49

Note. ¹Blank answers were also included in the values reported as incorrect data

less motivated. Still, throughout many years of studies, it has been shown that there is a high positive correlation between student attendance and participation and overall course performance (Zhu et al., 2019).

Summary

In summary, the effective evaluation of the dissemination of knowledge is paramount to all levels of education. In the current environment, constant adjustments and utilization of technology are vital to maintaining student engagement and participation. The data acquired in the current study provided insight into the best ways to assess basal knowledge and the transfer of information throughout an upper-level collegiate course. These data also suggest that the best way to assess the transfer and retention of information at the end of the semester is via an individual written assessment. However, establishing basal knowledge levels can be done through multiple avenues. The data in the current study indicates that in basal knowledge assessments participation is key. Students are much more likely to leave answers blank in an individual assessment,

specifically, early in a class. Therefore, initial assessments should create an engaging environment conducive to learning so that students will answer questions even if those answers are educated guesses. Student participation and engagement have changed post-pandemic. Thus, a major priority of instructors, now more than ever, needs to be focused on maintaining student participation. Future research should focus on the incorporation of technology that will promote student participation, thus, increasing the quality of the information obtained through pre- and post-assessments.

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