Student Success in a Mixed-Major Animal Behavior Course

Sarah Fauque

University of Louisville, Louisville, KY.

Abstract

Small institutions struggle to balance class size with financial feasibility, leading to canceled electives due to low enrollment. This study reports the preliminary data of a mixed-majors class intended to overcome the minimum enrollment hurdle. Animal Behavior was an upper-level course emphasizing engagement and shared learning. I examined graded assignments and student attitudes to determine if major or scientific background impacted student success. Participating students were evenly distributed across biology (n=9) and psychology (n=10) majors with similar median GPAs (3.8 vs 3.5, respectively). Major was the only predictor of final score ($f(1) = 5.69$, $p = 0.04$). While there was a significant difference in final scores between the majors (biology $\bar{x}$ = 93.29 ± 1.61 vs psychology $\bar{x}$ = 83.77 ± 2.88; $t(18) = 2.80$, $p = 0.01$), there was no difference in passing the class (final grade ≥ 70%; $X^2(1,19) = 0.95$, $p = 0.33$). Most students tended to respond more favorably in the final survey than the midterm survey, but biology majors tended to have a greater change in scores than psychology majors. Overall, these data suggest that an upper-level science elective can be successful for mixed-major cohorts, but replication is necessary to draw robust conclusions.

Introduction

The close learning environment of a small campus is often a selling point when recruiting potential students. Compared with large classes, small class sizes contribute to increased student success and graduation rates (Millea et al., 2018). Many institutions employ a minimum enrollment policy under which a class will only run if it is financially feasible. When small class sizes are due to the size of the program or institution, it can be challenging to meet the minimum enrollment requirement to run elective courses. This becomes particularly difficult when electives have prerequisite courses. This type of class cancellation often occurs at the beginning of the semester, causing students and faculty to scramble for another course to fill their schedule. While this experience is likely encountered across higher education, it is often experienced in small colleges and academic programs.

Some institutions take a proactive approach to address the frustrations of course cancellations by carefully tailoring their course offerings so that certain courses are only available in specific years to create a larger student pool with multiple cohorts of prepared students. This requires careful planning and scheduling to ensure courses do not compete for enrollment, causing students to miss out on a class that would benefit their future careers. It also imposes barriers for students who transfer or have changed majors and are not entering the suggested sequence of courses. Another solution developed by some institutions is to open historically low-enrollment elective courses to multiple majors. This solution also introduces new challenges, particularly for the instructor, due to the various student backgrounds. While some students will have a firm grasp of one concept, others will hear it for the first time. Effective teaching in these courses requires the instructor to meet students where they are by getting to know them and supporting their unique needs (Schouten, 2017).

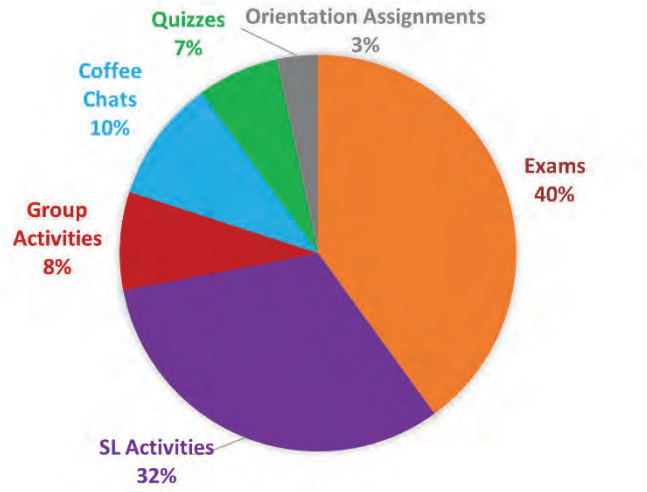
Here, I report on the developed curriculum and preliminary student data of a mixed-major class intended to overcome the minimum enrollment hurdle. Animal Behavior was an upper-level course offered at a small liberal arts college in south-central Kentucky. This institution has historically had difficulties meeting the minimum enrollment threshold for upper-level biology electives; thus, Animal Behavior was open to all students of at least Junior standing. This sets it apart from other animal behavior courses in Kentucky and offers a unique opportunity for all students, regardless of major, to explore behavioral biology.

Course Design

Animal Behavior was designed with an emphasis on engagement and shared learning. Student-centered syllabi have been shown to set a positive tone for a

course, and using friendly, descriptive language can increase student-faculty rapport (Richmond et al., 2016). In a mixed-major course, building a relationship of mutual respect is essential to foster a supportive learning environment and meet students where they are (Schouten, 2017). Thus, a student-centered syllabus sets the stage for future interactions and expectations. This is further supported by activities early in the semester designed to focus on forming relationships within the cohort and fostering a trusting environment. Lectures were punctuated with small group discussions, think-pair-share activities, and clicker questions so that students could bring their unique perspectives and claim space in the classroom (Schouten, 2017). Approximately half (47%) of the final grade was determined by content-heavy assessments such as quizzes and exams, and skills-heavy assessments determined the remaining 53% (Figure 1).

Figure 1: Graded course activities were divided into content-heavy (47%) and skills-heavy (53%) assessments. Content-heavy assessments are quizzes and exams that focus on critical concepts. Skills-heavy assessments practice building transferrable skills like teamwork, communication, and scientific literacy.



The content of Animal Behavior was divided into four modules. The first module introduced students to the learning management system and various assignments they would see throughout the semester. Practice assessments increase student performance and are recognized as highly effective learning strategies (Sly, 1999; Biwer et al., 2020), so I leveraged this as we began the semester. The remaining three modules explored the specifics of behavioral biology with a mix of low-stakes and high-stakes assessments modeled after the assessments students practiced in Module 1. Each module also included a quiz before the exam as a practice test to inform students which material needed further study.

The skills-heavy assessments focused on communication through Scientific Literacy (SL) paper discussions and Coffee Chats. Critically reviewing scientific literature can be daunting regardless of major. From informal conversations, students feel they should already know how to review technical articles even when they have no practical experience and assume that this is a skill they will intuitively acquire when they finish their degrees. Often, students become discouraged when they struggle to read this literature for the first time. SL paper discussions demonstrate that deep knowledge is not a prerequisite when starting a project but rather the curiosity and drive to understand and explore a field. The knowledge develops organically through the exploration of the topic and by finding answers to their questions.

SL paper discussions critically review classic and contemporary ethological literature over a selected topic in the semester. When preparing for the discussion, students followed a template that mirrors my experience in exploring new topics. It encouraged students to note content that was confusing—terms, methods, statistics— and modeled how to reduce their confusion by researching the topics themselves. The bulk of the template consisted of questions that practicing scientists ask themselves as they read an article, such as: “What is the overall purpose?”; “Do the methods appropriately address the question being asked?”; “Do the results support the conclusions?”. The students brought their completed template and notes to class to discuss the paper in a small group and then with the class at large. They were allowed to make revisions following the discussion before submitting their template to be graded.

Coffee Chats were designed to encourage students to consider their learning in the class and articulate areas of confusion through private, digital conversations between the student and instructor. These casual, low-steak assignments built rapport with the instructor and fostered a safe environment for students to ask questions. Each week, students responded to a required set of prompts that typically included common areas of confusion and a reflection on their learning. These assignments were due before the chapter was covered in a lecture. A quick review of

the responses provided insight into multiple students' misconceptions. The lecture content and discussions were then tailored for the cohort by highlighting these shared areas of confusion. Additionally, I responded to several prompts over the course of the semester to further foster conversation, build rapport, and encourage curiosity.

Leveraging student inquiry and fostering curiosity can provide additional support for students who entered Animal Behavior with lower GPAs or interest in the subject. Curiosity is a disposition that can be used as a proxy for lifelong learning and is suggested to be a pillar of academic performance (Fulcher, 2008; von Stumm et al., 2011). By nurturing intellectual curiosity, students can garner greater enjoyment from their studies than from intelligence and effort alone (von Stumm et al., 2011). This curriculum design provides the starting point for an approachable course while maintaining rigor and building critical thinking skills.

A potential consequence of opening an upper-level life science elective to non-life science majors is the disparity in preparation. Therefore, I aimed to determine if major or science background significantly impacted (1) academic success in Animal Behavior and (2) attitudes toward the course. If science background or major played a significant role in student academic success, then student grades, reflected in their final score, would differ, whereas students with more science preparation would earn higher scores because of their increased familiarity with the content. Predicting the response of attitudes towards the class is more complex. While some students may value the challenge of a difficult course, others may find it intimidating. As such, data were collected on attitudes towards the initiatives described above to leverage student experiences and their opinions on the content. This can provide feedback on student perceptions and fuel recommendations to increase student success in rigorous mixed-major electives.

Methods

Data Collection

In Fall 2021, 22 students were enrolled in Animal Behavior. This group consisted of Juniors and Seniors with majors in Biology, Human Services, and Psychology. Students were given a verbal and written explanation of the IRB-approved research and provided an informed consent form. As an incentive to participate, 15 extra credit points were awarded to those who joined the study. An alternative extra-credit assignment of equivalent effort worth 15 points was available for those who did not wish to participate. Students were informed that they could withdraw from the study at any time. Nineteen (N = 19) students agreed to participate in this research, consisting of biology (n=9) and psychology (n=10) majors.

The data collection consisted of three parts. (1) An onboarding survey where the students reported their major, academic year, grade point average (GPA; out of 4.0), and the number of science courses they completed before Fall 2021. (2) Two attitude surveys about how students felt about the course material, learning atmosphere, and student progress. These were delivered at midterm and after completing the final exam, but before final grades were posted. Surveys were not anonymous, but the students were informed that the responses were not reviewed until after final grades had been posted. (3) Graded work, including average exam score, average quiz score, and final scores.

All student data were downloaded and organized in an encrypted, password-protected Excel® spreadsheet saved to a password-protected hard drive. Each student was assigned a random number as an individual identifier with all data in the primary spreadsheet. All analyses were conducted on a de-identified copy of this spreadsheet, and the student order was rearranged to protect confidentiality and reduce the risk of bias.

Analysis

All analyses were conducted in R version 4.1.3, housed within R-Studio (R Core Team, 2021). The continuous variables were tested for normality using the Shapiro-Wilk test and homogeneity of variance via an F-test before continuing to analysis.

To determine the roles of major, preparation, and academic standing on the response variables of final score, exam averages, and quizzes, respectively, I ran three-way ANOVAs. The fixed effects were major, preparation, and standing. Major and standing each had two factors: biology/psychology and junior/senior, respectively. Preparation was divided into three factors according to the number of college science classes completed before Fall 2021. 'Low preparation' consisted of fewer than three courses, 'moderate preparation' consisted of 4-6 courses, and 'high preparation' consisted of 7-9 courses. It is important to note that psychology classes emphasizing the scientific

method were included as science preparation (e.g., Research I & II). The results of the attitudes surveys delivered during midterms and finals were assessed using Mann-Whitney U tests to determine if there was a difference in student feelings between psychology and biology majors.

Results

Median GPA did not differ between biology (3.8) and psychology (3.5) majors; thus, it was not included in further analyses (Mann-Whitney test, U = 59, p = 0.28). All continuous variables—final score, exam averages, and quiz averages—were normally distributed with p-values > 0.05. A linear regression shows that GPA predicts the final grade in Animal Behavior (r^2 = 0.71, p << 0.001, Figure 2). All averages are reported ± SE.

Of the fixed-effects analyzed, major (f(1) = 5.69, p = 0.04) was the only predictor of final score, whereas preparation (f(2) = 0.57, p = 0.58) and standing (f(1) = 0.06, p = 0.81) played no role. A post hoc t-test showed that biology majors ($\bar{x}$ = 93.29 ± 1.61) earned significantly more points than their psychology major peers ($\bar{x}$ = 83.77 ± 2.88; t(18) = 2.80, p = 0.01, Figure 3) by the end of the semester. A similar trend followed for exam averages but not quiz averages. Major (f(1) = 5.5, p = 0.04) was the only predictor of exam averages, whereas preparation (f(2) = 0.49, p = 0.63) and standing (f(1) = 0.01, p = 0.94) played no role. A post hoc t-test showed that biology majors ($\bar{x}$ = 82.87 ± 2.12) averaged significantly higher than psychology majors in their exams ($\bar{x}$ = 66.19 ± 5.36; t(18) = 2.89, p = 0.01, Figure 3). Quiz averages were not explained by major(f(1) = 2.02, p = 0.18, Figure 3), preparation (f(2) = 0.47, p = 0.64), or standing (f(1) = 1.05, p = 0.33).

Student response scores tended to change between midterm (Table 1) and final surveys (Table 2). There was no statistical difference in median scores between biology and psychology majors at midterm (Table 1). At finals, students differed significantly in their responses by major for questions 3, 5, 6, 11, and 12 (Table 2). In most instances, students responded more favorably in the final survey, with a few

Figure 2: GPA is predictive of the final score.

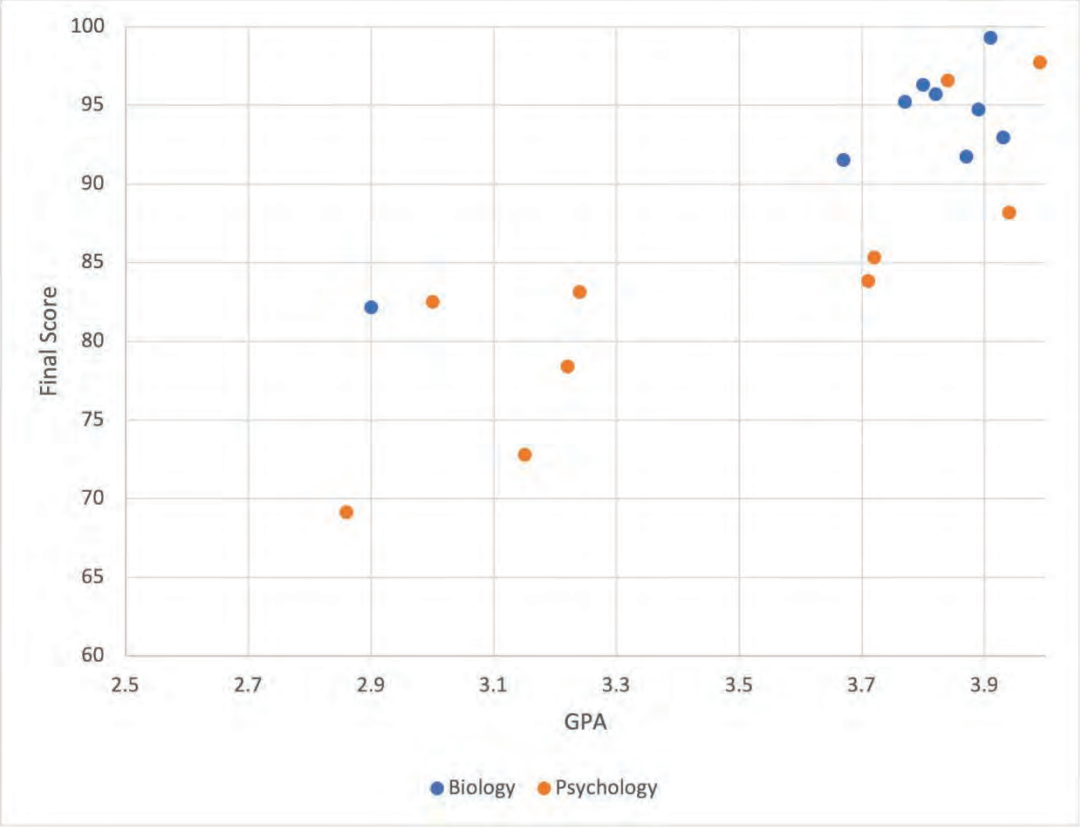


Table 1: Midterm responses for the attitude survey. Majors were similar in their responses to any question. These questions were scored on a 5-point Likert scale where 1 = Strongly disagree, and 5 = Strongly agree. The reported values are the percentage of students (N=19) who responded to each category.

Question	Question Text		Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree	*U*	*p-value*
Q1	I am comfortable in my learning environment.	*Biology*	26.32	0.00	5.26	5.26	10.53	*51*	*0.64*
		Psychology	10.53	15.79	15.79	5.26	5.26		
Q2	I learn something new each day.	*Biology*	26.32	5.26	0.00	5.26	10.53	*50.5*	*0.67*
		Psychology	15.79	21.05	0.00	10.53	5.26		
Q3	I am comfortable sharing my thoughts with my small group.	*Biology*	15.79	15.79	0.00	0.00	15.79	*46.5*	*0.93*
		Psychology	10.53	21.05	15.79	0.00	5.26		
Q4	I am comfortable sharing my thoughts with the group at large (e.g., the entire class).	*Biology*	21.05	5.26	10.53	5.26	5.26	*68*	*0.06*
		Psychology	0.00	15.79	0.00	26.32	10.53		
Q5	I am confident in my current scientific ability.	*Biology*	10.53	10.53	10.53	10.53	5.26	*59.5*	*0.24*
		Psychology	0.00	5.26	21.05	21.05	5.26		
Q6	I am doing well in this class.	*Biology*	15.79	5.26	15.79	5.26	5.26	*63*	*0.14*
		Psychology	0.00	5.26	26.32	10.53	10.53		
Q7	I enjoy the content of this class.	*Biology*	26.32	0.00	0.00	15.79	5.26	*53*	*0.52*
		Psychology	10.53	21.05	0.00	15.79	5.26		
Q8	I enjoy the organization of this class.	*Biology*	26.32	5.26	0.00	10.53	5.26	*54.5*	*0.45*
		Psychology	10.53	21.05	10.53	5.26	5.26		
Q9	I find the coffee chats helpful.	*Biology*	21.05	5.26	0.00	10.53	10.53	*42.5*	*0.87*
		Psychology	15.79	15.79	5.26	15.79	0.00		
Q10	I find the group activities helpful.	*Biology*	26.32	5.26	0.00	0.00	15.79	*48.5*	*0.79*
		Psychology	15.79	26.32	0.00	5.26	5.26		
Q11	The Scientific Literacy assignments are improving my understanding of science.	*Biology*	21.05	10.53	0.00	5.26	10.53	*54*	*0.47*
		Psychology	5.26	26.32	5.26	10.53	5.26		
Q12	Since the class began, I have grown in my scientific understanding.	*Biology*	21.05	10.53	0.00	5.26	10.53	*54.5*	*0.45*
		Psychology	10.53	10.53	15.79	5.26	10.53		

exceptions (Table 3). Biology students tended to report a lower level of comfort with sharing in large groups, while psychology students tended to increase their comfort in these discussions from midterms to finals. However, psychology students split their preferences for small group discussions, enjoying class content and group activities. Here, some students tended to report more favorably, while others tended to vote less favorably.

Discussion

These preliminary data indicate that major plays a significant role in a student's academic success in and attitudes towards Animal Behavior when it is delivered as a mixed-cohort upper-level course. Although biology major GPA was numerically higher than psychology majors, the difference was not significant. Psychology majors clustered in two groups where roughly half the class had a GPA greater than 3.6 and half had a GPA below 3.3. Most biology majors cluster with the

Table 2: Final responses for attitude survey. Majors differed significantly in several questions (signified by bolded p-values). These questions were scored on a 5-point Likert scale, where 1 = Strongly disagree, and 5 = Strongly agree. The reported values are the percentage of students (N=19) who responded to each category.

Question	Question Text		Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree	*U*	*p-value*
Q1	I am comfortable in my learning environment.	*Biology*	26.32	10.53	5.26	5.26	0.00	*62.5*	*0.15*
		Psychology	10.53	21.05	5.26	10.53	5.26		
Q2	I learn something new each day.	*Biology*	36.84	5.26	0.00	5.26	0.00	*66.5*	*0.06*
		Psychology	15.79	21.05	0.00	10.53	5.26		
Q3	I am comfortable sharing my thoughts with my small group.	*Biology*	42.11	0.00	0.00	0.00	5.26	*68.5*	***0.04***
		Psychology	15.79	21.05	0.00	10.53	5.26		
Q4	I am comfortable sharing my thoughts with the group at large (e.g., the entire class).	*Biology*	15.79	10.53	5.26	10.53	5.26	*54.5*	*0.45*
		Psychology	10.53	5.26	15.79	10.53	10.53		
Q5	I am confident in my current scientific ability.	*Biology*	21.05	15.79	5.26	5.26	0.00	*73.5*	***0.02***
		Psychology	0.00	10.53	31.58	5.26	5.26		
Q6	I am doing well in this class.	*Biology*	26.32	10.53	5.26	5.26	0.00	*71.5*	***0.03***
		Psychology	0.00	26.32	10.53	5.26	10.53		
Q7	I enjoy the content of this class.	*Biology*	31.58	5.26	5.26	5.26	0.00	*62.5*	*0.14*
		Psychology	15.79	15.79	5.26	5.26	10.53		
Q8	I enjoy the organization of this class.	*Biology*	36.84	5.26	0.00	5.26	0.00	*66*	*0.07*
		Psychology	15.79	21.05	5.26	5.26	5.26		
Q9	I find the coffee chats helpful.	*Biology*	26.32	10.53	5.26	5.26	0.00	*62*	*0.16*
		Psychology	10.53	21.05	5.26	15.79	0.00		
Q10	I find the group activities helpful.	*Biology*	31.58	10.53	0.00	0.00	5.26	*57*	*0.30*
		Psychology	21.05	21.05	0.00	0.00	10.53		
Q11	The Scientific Literacy assignments are improving my understanding of science.	*Biology*	26.32	15.79	0.00	0.00	5.26	*68.5*	***0.05***
		Psychology	5.26	21.05	15.79	10.53	0.00		
Q12	Since the class began, I have grown in my scientific understanding.	*Biology*	42.11	0.00	0.00	5.26	0.00	*69.5*	***0.03***
		Psychology	15.79	15.79	10.53	5.26	5.26		

psychology majors with GPAs above 3.6, with one outlier in the second psychology cluster (Figure 2). This observed clustering of the data likely drove the numerical, yet non-significant, difference in GPA between the majors. Unsurprisingly, GPA is related to final score, as found elsewhere (Bazelais et al., 2016).

Psychology students consistently scored at least 1.5 letter grades lower on content-heavy assessments than biology students. Two psychology students earned scores equivalent to their reported GPA, but the remaining eight earned scores in the mid-80s or below (Figure 2). A recent study by Tomkin and West (2022) suggests that observed GPA is a misleading measure of academic performance when comparing science, technology, engineering, and mathematics (STEM) students with non-STEM students. Researchers examined the grades of 64,860 students (STEM vs non-STEM; n = 35,034 vs n = 39,826) over 10 years (2006 to 2015 inclusive) to evaluate inter-course grading disparities and assess GPA models. Their results show that STEM majors are graded more stringently than non-STEM majors. STEM students had greater academic success than their non-STEM peers even though their observed GPAs were similar. However, heterogeneity among STEM disciplines was also present, where engineering students' GPAs were depressed more compared with biology students' GPAs. The authors reported that biology and psychology student GPAs show different inflation levels, but it is unclear whether the difference between them is significant. Tomkin and West encourage using a weighted logistic model of GPA when comparing student performance. This could provide a truer sense of prior academic performance and account for prior grade disparities between the majors. While this is outside the scope of the current project, future replications of this research would benefit by including this model.

The primary hypothesis of this study defined academic success as the final score. However, if we were to define success as passing the course (earning 70% or higher), then we reach a different conclusion. An exploratory post hoc X^2 test showed no difference in passing the class between the majors ($X^2(1,19) = 0.95$, $p = 0.33$, Figure 4). However, there was a significant difference between the majors for passing exams ($X^2(1,19) = 9.98$, $p = 0.002$) and quizzes ($X^2(1,19) = 9.02$, $p = 0.003$; Figure 4), suggesting that students were raising their final grades through the other assignments. Mixed assessment methods have been shown to reduce the performance gap, making courses more equitable (Cotner and Ballen, 2017).

Figure 3: Biology majors (n=9) scored significantly higher in final grades and exams than psychology majors (n=10). This trend is similar for quiz averages but is not statistically significant (N=19).

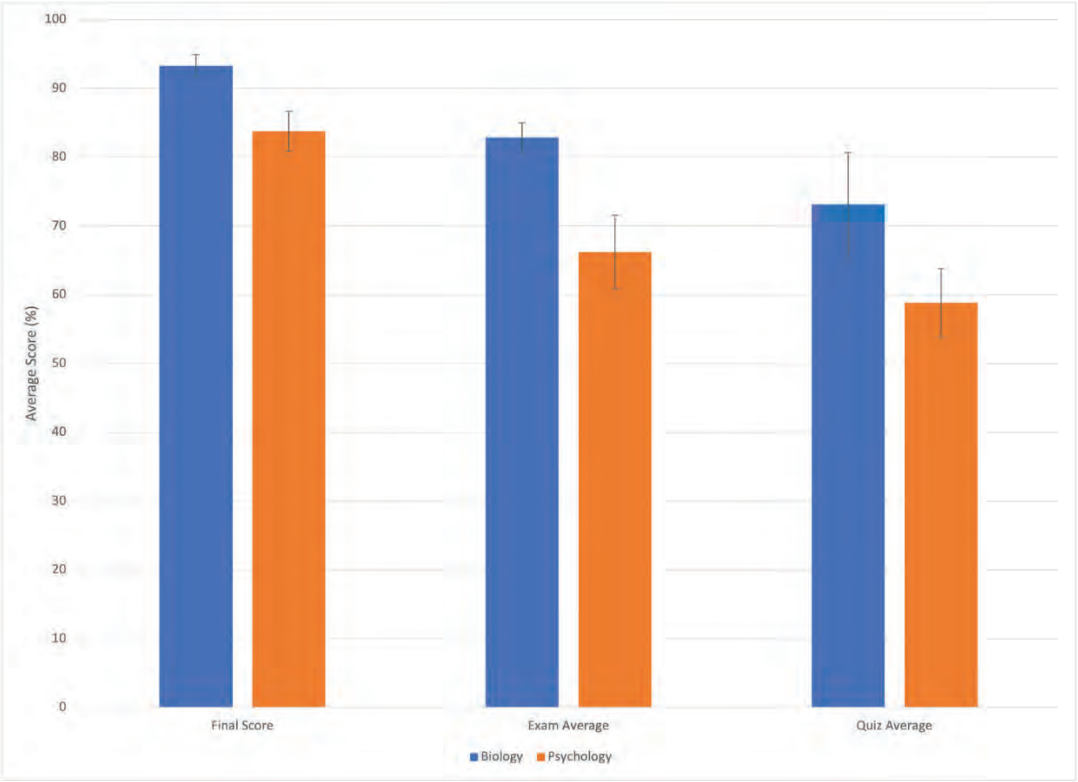
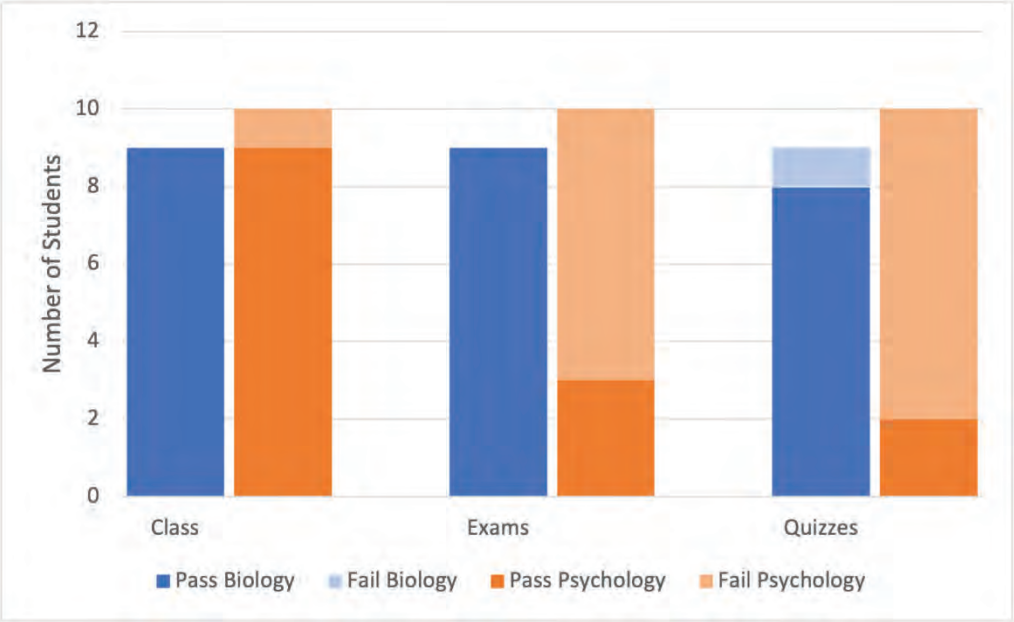


Figure 4: Measuring class success by pass (≥70%) fail (<70%; N=19).



Content-heavy, high-stakes exams and quizzes made up the bulk of the final grade in Animal Behavior, but it is evident that the low-stakes assessments bolstered these grades. Future sections of this course would benefit from revisiting the syllabus to consider other ways of distributing points, with more low-stakes assignments targeted at content knowledge. In addition to providing opportunities to practice with this content before attempting high-stakes assessments, the redistribution of points may make the course more accessible for all.

Although psychology students consistently scored lower, they reported feeling they were doing well in the class. Attitudes toward the class were only significantly different for the final exam survey. These differences were likely driven by the greater magnitudes of change where biology students swung from 'strongly disagree' to 'agree' or 'strongly agree' (Table 3). Biology students tended to score more strongly and positively than psychology students, whose responses were more distributed across the options. However, we see a positive trend for psychology students feeling more comfortable in class and their scientific ability.

One factor leading to feeling more comfortable in the class could be changes in the module focus. The early modules of Animal Behavior focus on the proximal mechanisms of behavior, including genetics and physiology, which lays the foundation for other modules. These mechanisms build upon concepts that all students have seen in either Introduction to Psychology or Introduction to Biology I/II. However, biology students and those interested in physiological psychology likely entered Animal Behavior with a stronger understanding of these mechanisms. At the same time, the rest of the students had not seen these topics since early in their academic careers. The modules covered after the midterm were likely more familiar to psychology students because they explored concepts like learning, social dynamics, and parental care. I would recommend adding pre-class review assignments or games specifically for the proximal mechanism modules. This can inform all students of the depth of understanding I'm expecting as we start discussing these concepts and remind them that they have seen these topics before.

Another factor leading to increased comfort over time in Animal Behavior could be attributed to increased camaraderie among discussion group members. This study was conducted when COVID-19 safety measures were in place; thus, discussion groups were determined according to where the students sat and remained consistent throughout the semester. While this allowed for a small level of self-selection due to sitting with peers, sometimes peer groups were split because of how the rows were divided. This led to groups with heterogeneous backgrounds, some of which were composed of mostly one major and one or two students of a different major. As the students moved through the content with their discussion group members, they may have increased their confidence in

Table 3: Difference in responses between midterm and final attitude surveys. Positive changes are highlighted with bold text, while negative changes are highlighted with italicized text. Questions with a significant difference in major responses are bolded with an asterisk *.

Question	Question Text		Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
Q1	I am comfortable in my learning environment.	*Biology*	0	**10.53**	0	0	*-10.53*
		Psychology	0	**5.26**	*-10.53*	**5.26**	0
Q2	I learn something new each day.	*Biology*	**10.53**	0	0	0	*-10.53*
		Psychology	0	0	0	0	0
Q3*	**I am comfortable sharing my thoughts with my small group.**	*Biology*	**26.32**	*-15.79*	0	0	*-10.53*
		Psychology	**5.26**	0	*-15.79*	**10.53**	0
Q4	I am comfortable sharing my thoughts with the group at large (e.g., the entire class).	*Biology*	*-5.26*	**5.26**	*-5.26*	**5.26**	0
		Psychology	**10.53**	*-10.5*	**15.79**	*-15.79*	0
Q5*	**I am confident in my current scientific ability.**	*Biology*	**10.53**	**5.26**	*-5.26*	*-5.26*	*-5.26*
		Psychology	0	**5.26**	**10.53**	*-15.79*	0
Q6*	**I am doing well in this class.**	*Biology*	**10.53**	**5.26**	*-10.53*	0	*-5.26*
		Psychology	0	**21.05**	*-15.79*	*-5.26*	0
Q7	I enjoy the content of this class.	*Biology*	**5.26**	**5.26**	**5.26**	*-10.53*	*-5.26*
		Psychology	**5.26**	*-5.26*	**5.26**	*-10.53*	**5.26**
Q8	**I enjoy the organization of this class.**	*Biology*	**10.53**	0	0	*-5.26*	*-5.26*
		Psychology	**5.26**	0	*-5.26*	0	0
Q9	I find the coffee chats helpful.	*Biology*	**5.26**	**5.26**	**5.26**	*-5.26*	*-10.53*
		Psychology	*-5.26*	**5.26**	0	0	0
Q10	I find the group activities helpful.	*Biology*	**5.26**	**5.26**	0	0	*-10.53*
		Psychology	**5.26**	*-5.26*	0	*-5.26*	**5.26**
Q11	The Scientific Literacy assignments are improving my understanding of science.	*Biology*	**5.26**	**5.26**	0	*-5.26*	*-5.26*
		Psychology	0	*-5.26*	**10.53**	0	*-5.26*
Q12*	**Since the class began, I have grown in my scientific understanding.**	*Biology*	**21.05**	*-10.53*	0	0	*-10.53*
		Psychology	**5.26**	**5.26**	*-5.26*	0	*-5.26*

their understanding of the topics and their trust in each other. In future course iterations, I recommend assigning students to discussion groups. This will ensure that various backgrounds and voices contribute to the discussion in the small group setting and could reduce the likelihood of being the only member of a particular major.

While illuminating, this study has limitations. These data are from one semester of students with various levels of interest in animal behavior. Although there is an even distribution of students between biology and psychology majors, the sample size is still small (N = 19). Furthermore, because of the campus' size, there were limited upper-level courses that students could enroll in, resulting in some students taking Animal Behavior as a last resort. Several psychology students disclosed to me after the course was complete that they enrolled in Animal Behavior because it was the only upper-level that fit their schedule. While this would have been an interesting layer to add to the analysis, the surveys did not include 'interest in animal behavior'. A larger sample size across multiple years with survey questions relating to interest in animal behavior would likely provide more robust data to draw conclusions.

Conclusions

Overall, these data suggest that a student-centered upper-level elective emphasizing critical thinking and transferrable skills can be successful. Still, changes to the syllabus to redistribute points toward lower-stakes assignments should be considered to improve equitability and student comfort early in the semester. Future iterations of this research should consider a weighted logistic model of GPA to account for prior grading disparities and have a truer sense of prior academic performance.

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