



MPE Exam and Student Success among Biology and Zoology Majors

Project Goal: To explore whether students' incoming math ability predicts student success among Biology or Zoology majors.

Purpose: To inform students if and how incoming math ability impacts student success. This information is intended to assist students with decisions in major changes earlier in their undergraduate careers and provide evidence for advancing one's math abilities.

Background: Biology advisors anecdotally note those who don't place into MATH 117 or higher seem to struggle more in Biology majors and ultimately switch into a different major. We would like to evaluate whether or not these observations are true.

Research Question 1

What is the likelihood that a student will graduate with a Biology or Zoology degree based on incoming math ability?

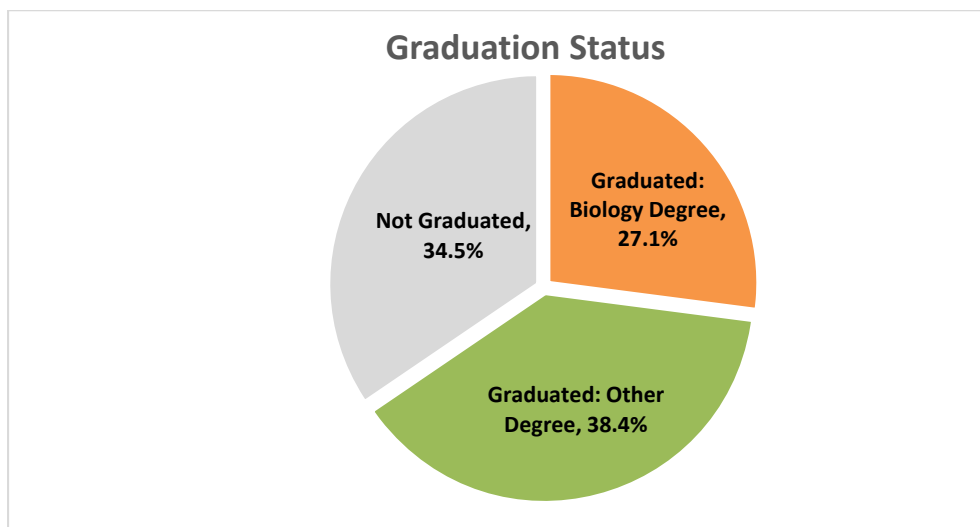
Population: New undergraduate students in fall cohorts (2005-2010) who have ever declared a major in the Biology department (Zoology or Biology) (n = 2,191)

- 71% (1,545 of the 2,191 students) had starting cohort majors in Biology

Predictor variable: 1st Math Placement Exam (MPE) composite score (sum of all scores: MC00, MC17, MC18, MC24, MC25, MC26)

Response variable: Graduated with a major in the Biology department (Yes/No)

Figure 1. Overall graduation status among students who ever had a major in Biology



- Among all students who at one point had a Biology major, 38% graduated with a degree in Biology. Among just those students who graduated CSU and at one point had a Biology major (n = 1,435), 59% graduated with a degree in the Biology department and 41% graduated from another department.



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Figure 2a. Initial cohort major among students who ever had a major in Biology

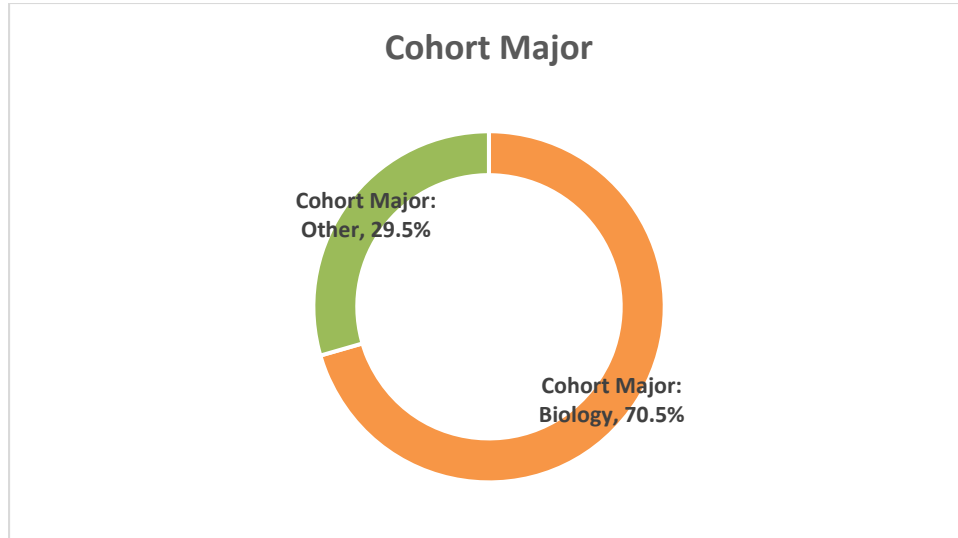
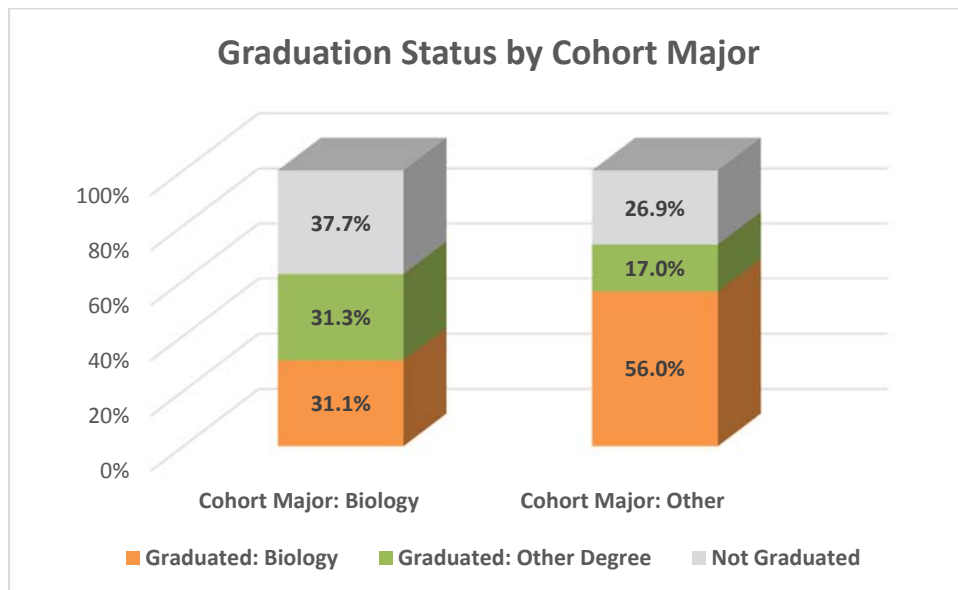


Figure 2b. Graduation status by initial cohort major among students who ever had a major in Biology



- The majority of students (71%) who ever had a major in Biology enrolled at CSU with a cohort major of Biology. Among these students, 31% graduated with a degree in Biology and 31% with a degree in another department (38% did not graduate or have not yet graduated).



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Figure 3a. Graduation status among students who ever had a major in Biology by cohort term

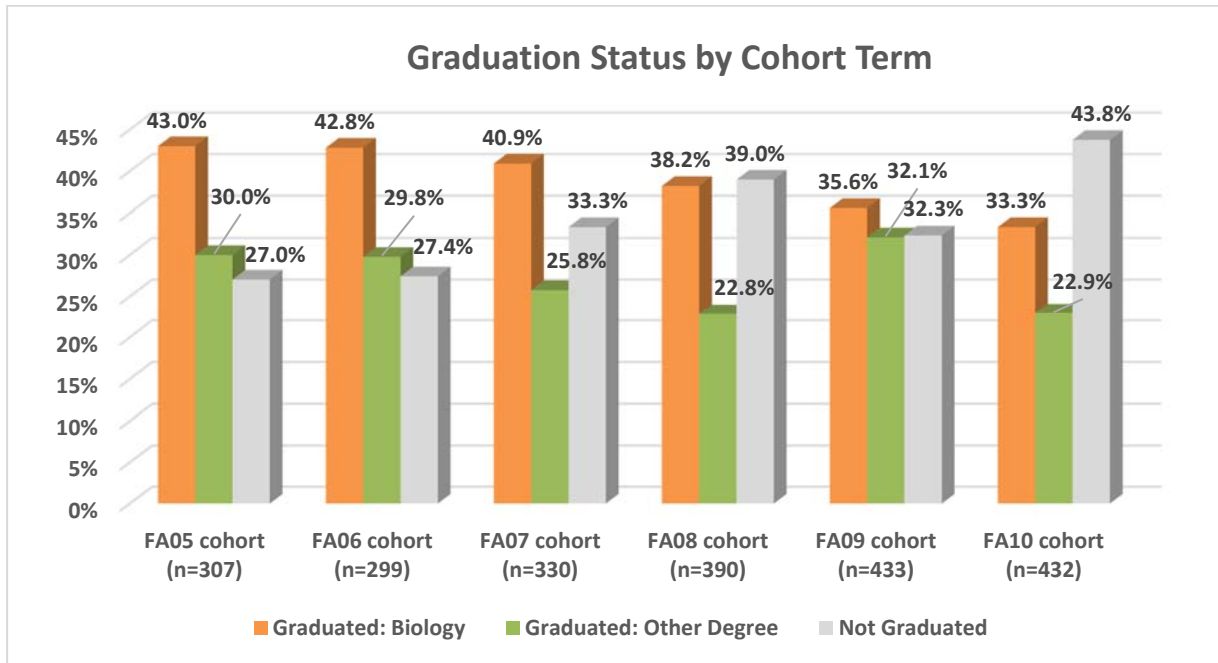
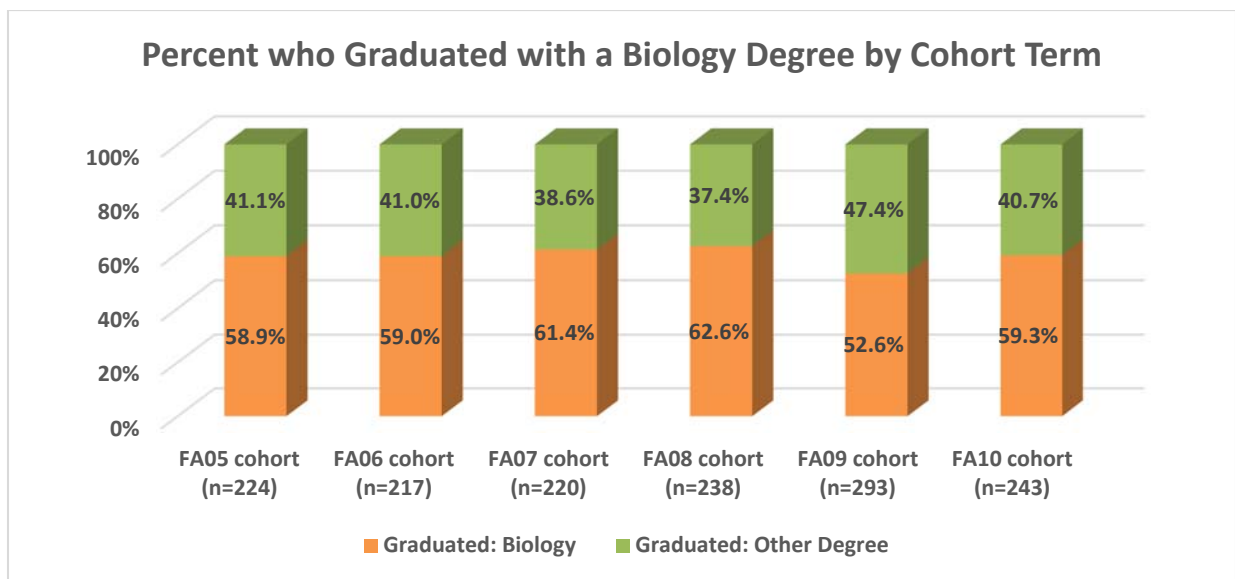


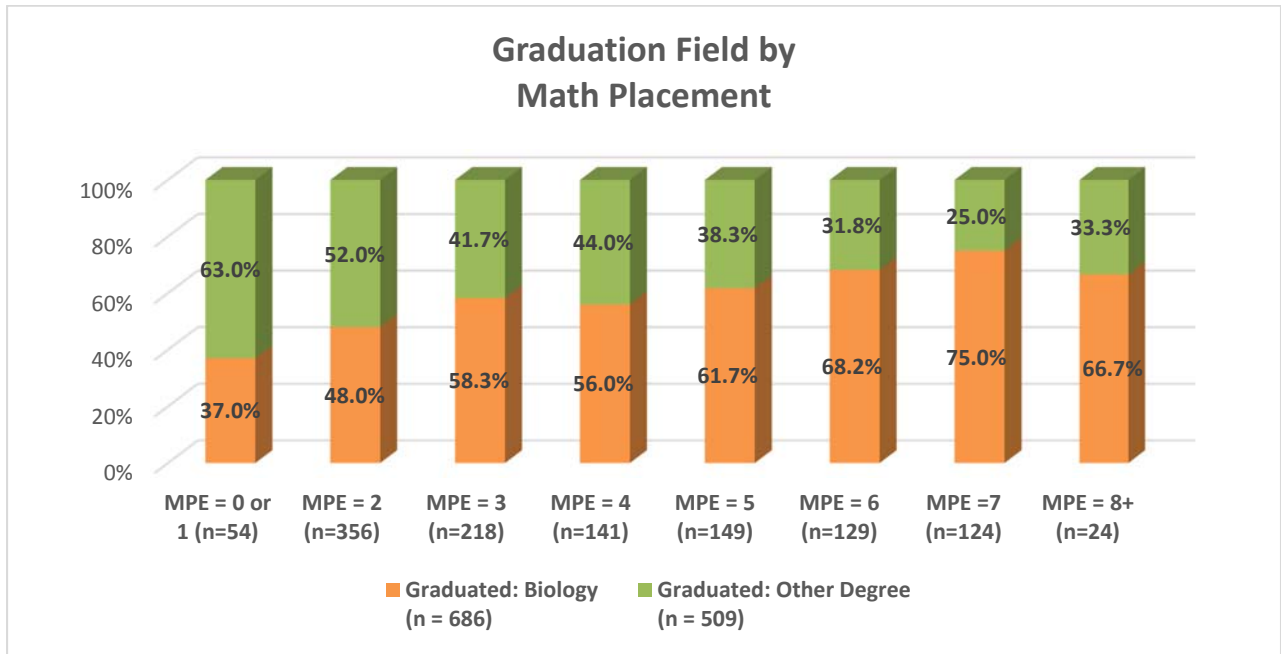
Figure 3b. Graduation field among graduated students who ever had a major in Biology by cohort term





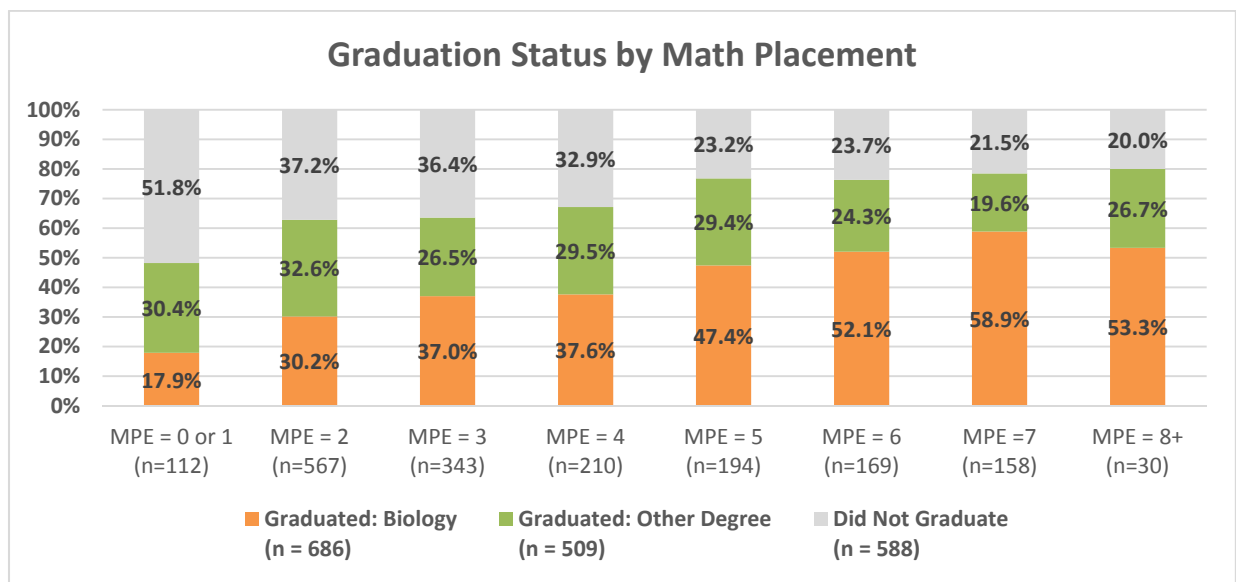
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Figure 4a. Graduation field among graduated students who ever had a major in Biology by MPE total score



*The MPE exam scores ranged from 0-12. Only one student had an MPE score of 1 and only one student had the max MPE score of 12.

Figure 4b. Graduation status among students who ever had a major in Biology by MPE total score





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Table A. Average MPE total score by graduation field among students who ever had a major in Biology

	#	Avg. MPE Total Score	SD
Graduated: Biology Degree	686	4.11	2.02
Graduated: Other Degree	509	3.37	1.94
Not Graduated	588	3.12	1.91

Table B. Average MPE total score by graduation field among students who ever had a major in Biology by demographic

	Average Math Total Score						
	Total	Men	Women	Non-Minority	Minority	Non-Pell Recipient	Pell Recipient
#	1,783	525	1,258	1,464	319	1,464	319
Graduated: Biology Degree	4.11	4.06	4.13	4.20	3.57	4.12	4.08
Graduated: Other Degree	3.37	3.73	3.21	3.52	2.60	3.47	2.79
Not Graduated	3.12	3.26	3.04	3.15	3.00	3.24	2.75
All Students	3.57	3.66	3.53	3.68	3.07	3.66	3.14



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Research Question 1 Findings:¹

- Undergraduates who graduated with a Biology degree had a significantly higher mean MPE total score (mean = 4.11) than those students who at one point had a major in Biology, but who graduated in a department other than Biology (mean = 3.37) ($p < .01$).
- There were no overall significant mean differences in math total scores by gender; however minority students and Pell recipients had significantly lower MPE total scores on average than non-minorities and non-Pell recipients ($p < .01$).
- A binary logistic regression showed the MPE total score to be positively associated with graduation in Biology among those graduated students who ever declared a Biology major ($p < .01$). This remained significant above and beyond the impact of gender, minority status, and Pell status on graduation field. For a one-unit increase in the MPE total score, a student had a 21% increase in odds of graduating with a Biology degree.
- The MPE total score explained 5% of the variance in graduation field and predicted 60% of the students' graduation degree correctly.
- When specifically looking at the six individual MPE scores in a logistic regression model, MC 17 and MC 24 scores were uniquely positively associated with graduation in Biology among those graduated students who ever declared a Biology major ($p < .01$). For every one point increase in the MP 17 or MC 24 score (0, 1, or 2), a student has 55% and 58% (respectively) higher odds of graduating with a Biology degree than in another field. The other four exams were not significant predictors of graduation field. Therefore, student scores on MC 17 and MC 24 may be of particular interest when examining likelihood of graduating with a Biology degree. In total, the model with the six MPE scores also explained 5% of the variance in graduation field and predicted 60% of the students' graduation degree correctly.

¹ There were 408 students who did not have MPE scores and were removed from any MPE score analysis. Of those students with no MPE score, 38% graduated in Biology, 21% graduated in another field, and 41% did not graduate.



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Research Question 2

Does incoming math ability predict performance in upper-level core Biology classes among Biology majors?

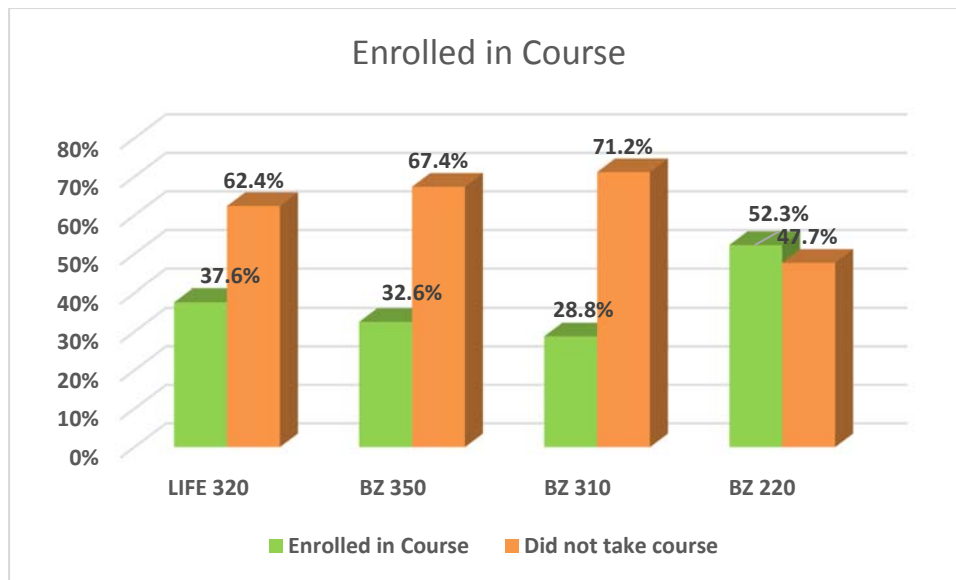
Population: New undergraduate students in fall cohorts (2005-2014) who have ever declared a major in the Biology department (Zoology or Biology) (n = 3,923)

- 77% (3,034 of the 3,923 students) had starting cohort majors in Biology

Predictor variable: 1st Math Placement Exam (MPE) composite score (sum of all scores: MC00, MC17, MC18, MC24, MC25, MC26)

Response variable: Grades (first attempt) LIFE 320, BZ 350, BZ 310, and BZ 220,

Figure 5. Percent of students who ever had a major in Biology and enrolled in course





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Figure 6. Course performance among students who ever had a major in Biology²

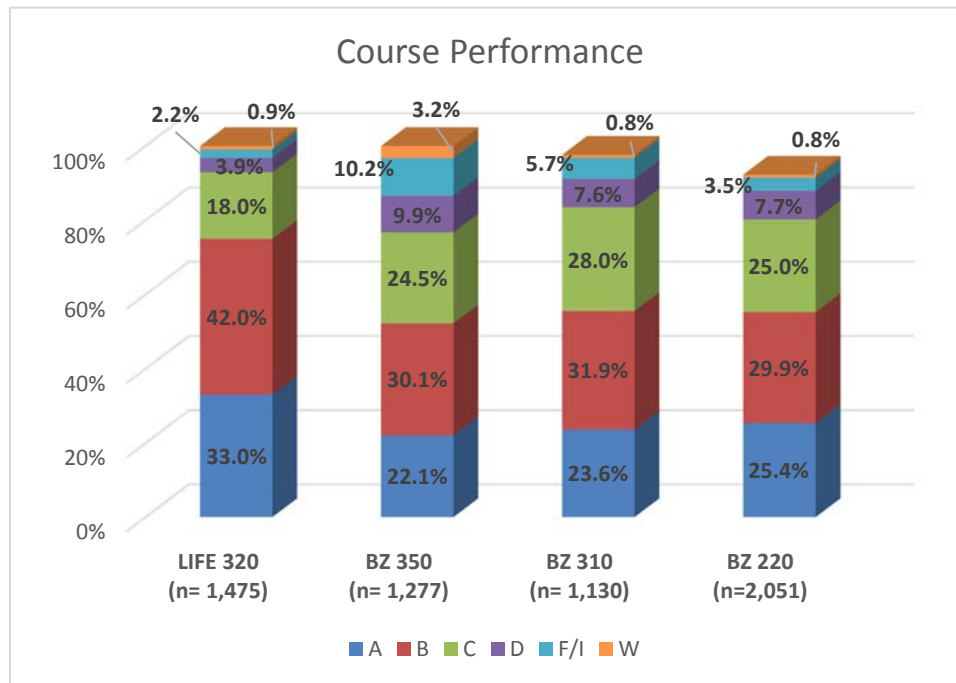


Table C. Average grade point among students who ever had a major in Biology³

	Cohort Major: Biology		Cohort Major: Other		Total Students	
	#	Avg. Grade Point	#	Avg. Grade Point	#	Avg. Grade Point
LIFE 320	963	3.04	498	2.90	1,461	2.99
BZ 350	760	2.58	474	2.30	1,234	2.47
BZ 310	658	2.67	433	2.57	1,091	2.63
BZ 220	1,352	2.79	680	2.73	2,032	2.77

² Grade distribution tables and figures were collapsed into whole grades for summary purposes (Figures 6-7). For example, course grades of B+ and B- were categorized as 'B'. However, grades were not collapsed when reporting mean grade point values.

³ Grade Point Conversion (Table C and Figure 7): A+/A = 4.0, A- = 3.67, B+ = 3.33, B = 3.0, B- = 2.67, C+ = 2.33, C = 2, C- = 1.67, D = 1.0, F or U = 0. Students who received a final course grade of 'W' or 'I' were excluded for this analysis.

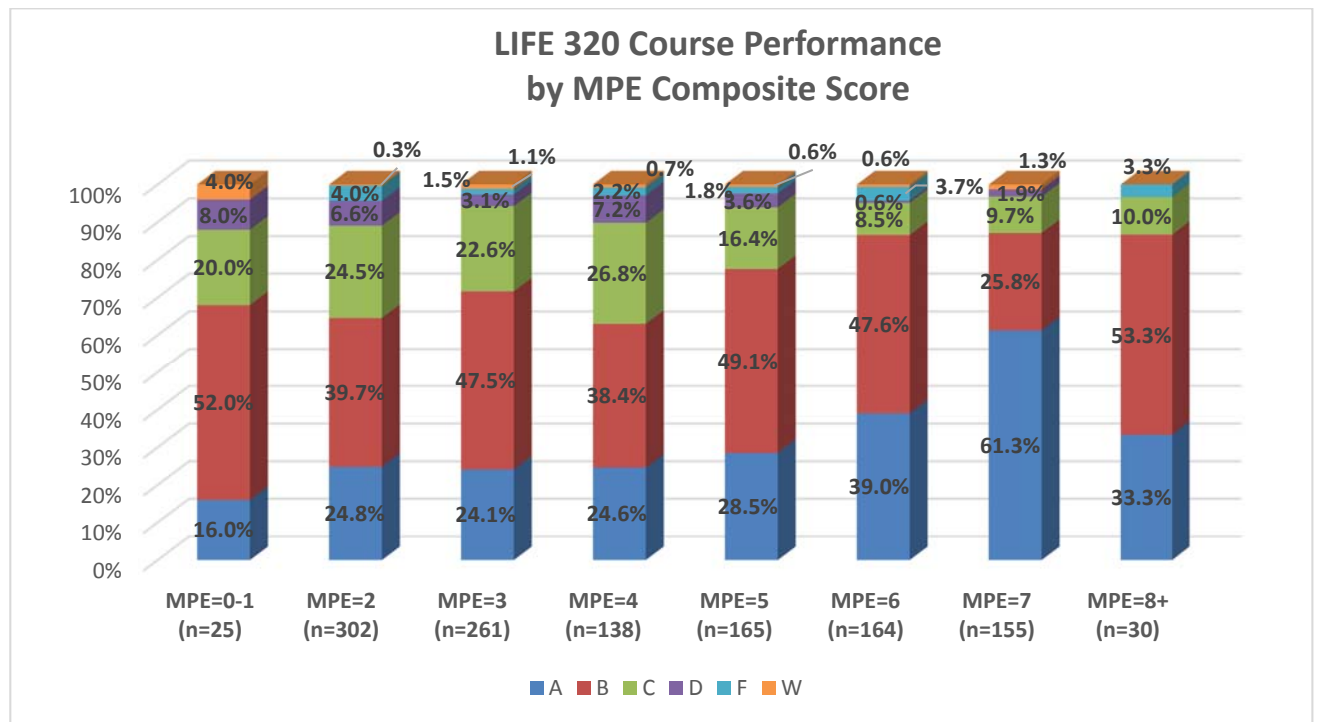


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Table D. Average MPE composite score by course among students who ever had a major in Biology

	#	Avg. MPE Score	SD
LIFE 320	1,240	4.12	1.99
BZ 350	509	3.37	1.94
BZ 310	927	4.20	2.01
BZ 220	1,717	3.87	1.98
Total	3,264	3.58	.93

Figure 7a. MPE Composite Score by LIFE 320 course performance among students who ever had a major in Biology





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Figure 7b. MPE Composite Score by BZ 350 course performance among students who ever had a major in Biology

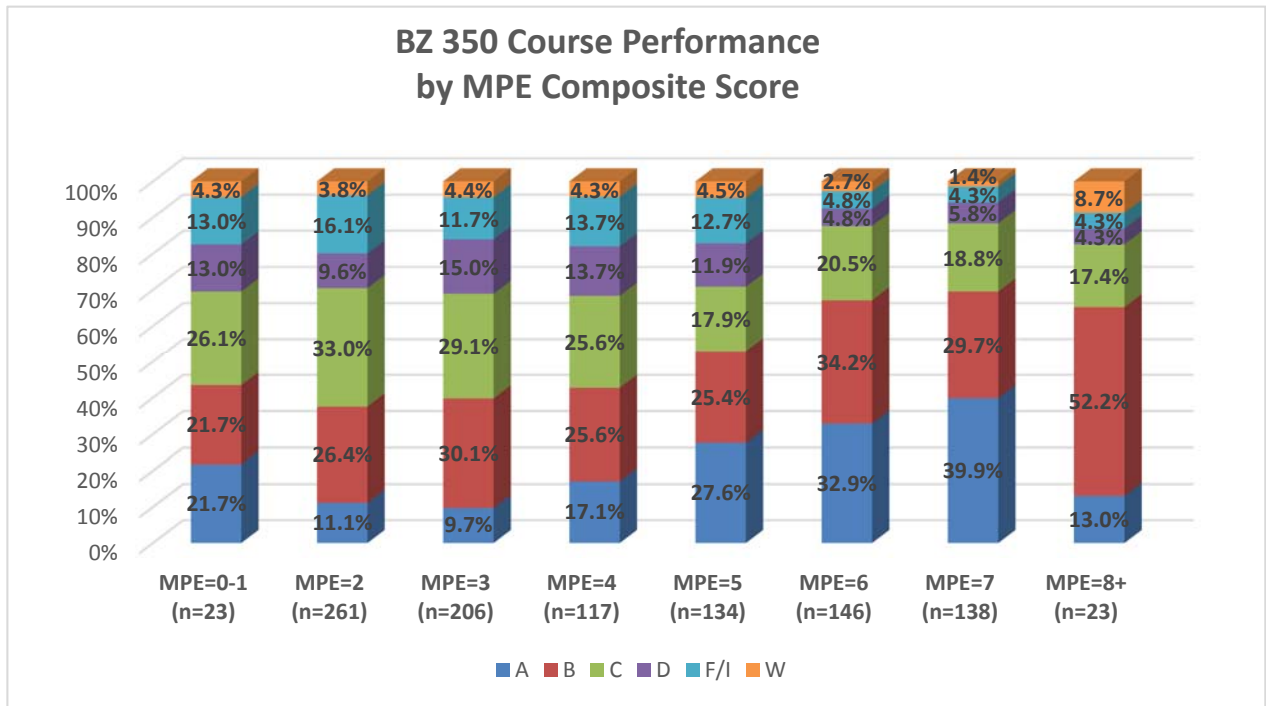
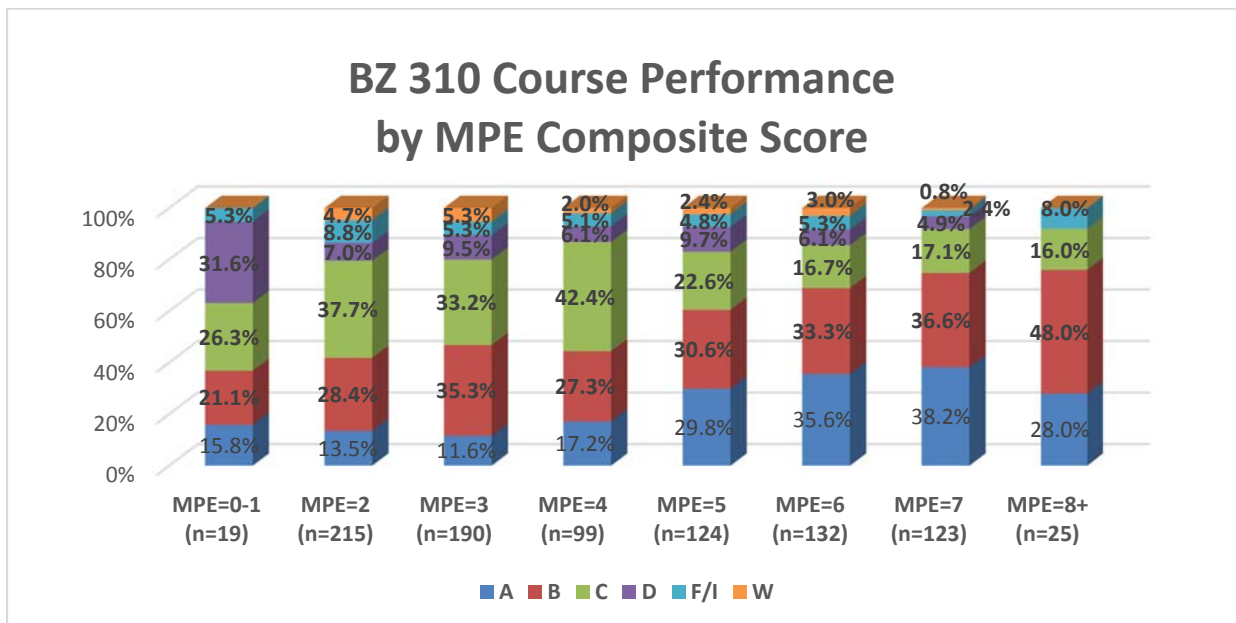


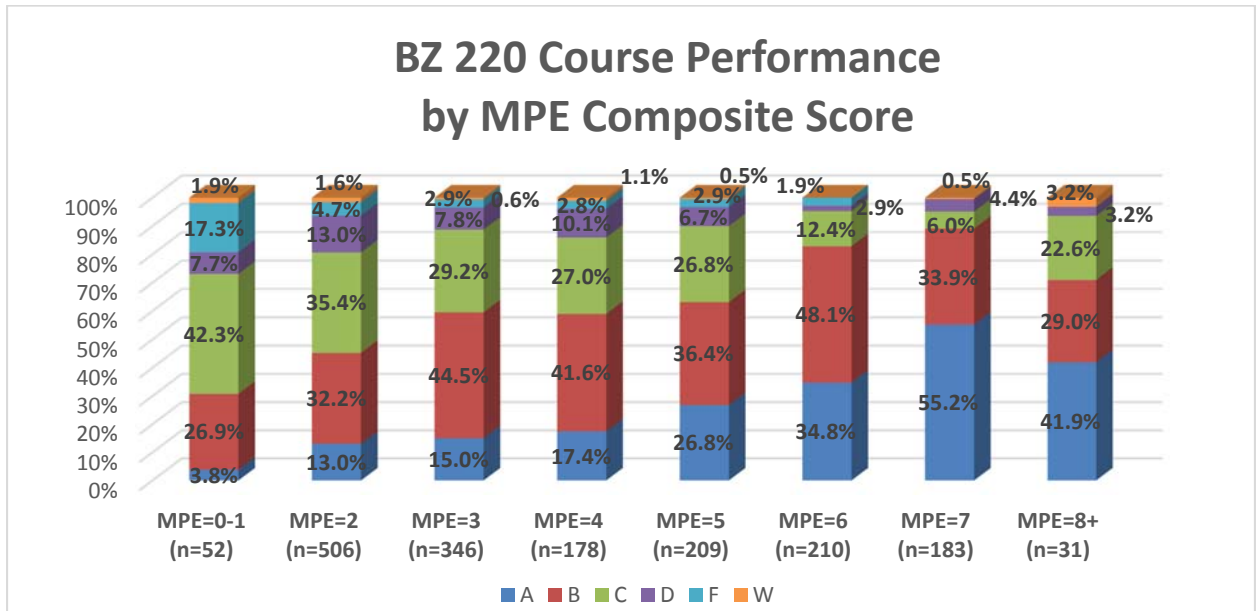
Figure 7c. MPE Composite Score by BZ 310 course performance among students who ever had a major in Biology





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Figure 7d. MPE Composite Score by BZ 220 course performance among students who ever had a major in Biology



Research Question 2 Findings:

- A linear regression showed the MPE composite score positively and significantly predicted higher grade points for all four courses among students who ever declared a Biology major ($p < .01$). This remained significant above and beyond the impact of gender and minority status on course grade.
- Though the relationship between MPE score and course grades were all significant, MPE score had the greatest impact on student grades for BZ 220 ($B = .18$) and BZ 350 ($BZ = .16$) and a slightly lesser impact on BZ 310 ($B = .13$) and LIFE 310 ($B = .10$) grades. The MPE composite score explained a minimum of 5% (LIFE 320) and a maximum of 12% (BZ 220) of the variance in course grade.
- When specifically looking at the six individual MPE scores in a linear regression model, MC 24 scores, above and beyond the impact of the other exams, positively predicted a higher course grade in each of the four courses among those graduated students who ever declared a Biology major ($p < .05$). MC 26 was also a significant, unique predictor for LIFE 320 ($p < .01$). Four of the six individual MPE tests were significant predictors for BZ 220 ($p < .05$) (MC 18 and MC 25 were not significant).
- When controlling for MPE composite score, non-minority and female students were positively associated with higher course grade in BZ 350 and BZ 220. Additionally, females were positively associated with a higher course grade for LIFE 320 as well ($p < .01$), but minority status was not a significant predictor. Gender and minority status were not significantly associated with BZ 310 course grade.