



Predicting Success in Undergraduate Chemical Engineering at the United States Military Academy



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Abstract

This study examines a composite preadmissions tool created and used by the United States Military Academy as a predictor of success in the chemical engineering major. Our results suggest a positive correlation between this preadmissions tool, successful graduation, and performance on the Fundamentals of Engineering Exam (FEE). Sixty-five percent of all FEE failures from 2006-2019 at West Point had an at-risk score prior to admission. Grade Point Average analysis further examined the class rank impacts of majoring in chemical engineering.

Background

- Admissions tools predict successful graduation
- But are they valid for a challenging major?
- Unique Challenges of West Point
 - 47 Month Experience
 - Every Cadet an Athlete (daily practice)
 - Leadership positions
 - Summer/Weekend Military Training
 - Mandatory Military Courses
 - Mandatory Physical Education Courses
 - Branch (Infantry/Armor/Aviation) & Post (GPA dependent)
 - 2.5 extra courses (Chem Engineering)
 - FEE (Engineering Majors)
- Whole Candidate Score (WCS)*
- College Entrance Examination Rank (Academic Ability)
 - SAT/ACT + High School Class Rank (Adjusted)

Results

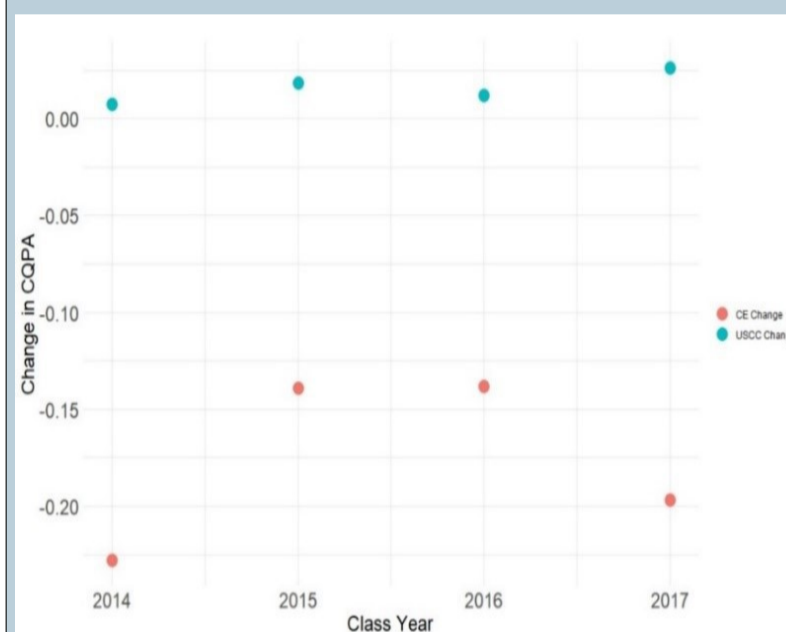


Figure 1. Change in CQPA from 1st Semester to graduating CQPA for Chemical Engineering (CE) majors and all graduates by class year United States Corps of Cadets (USCC) classes 2014 to 2019.

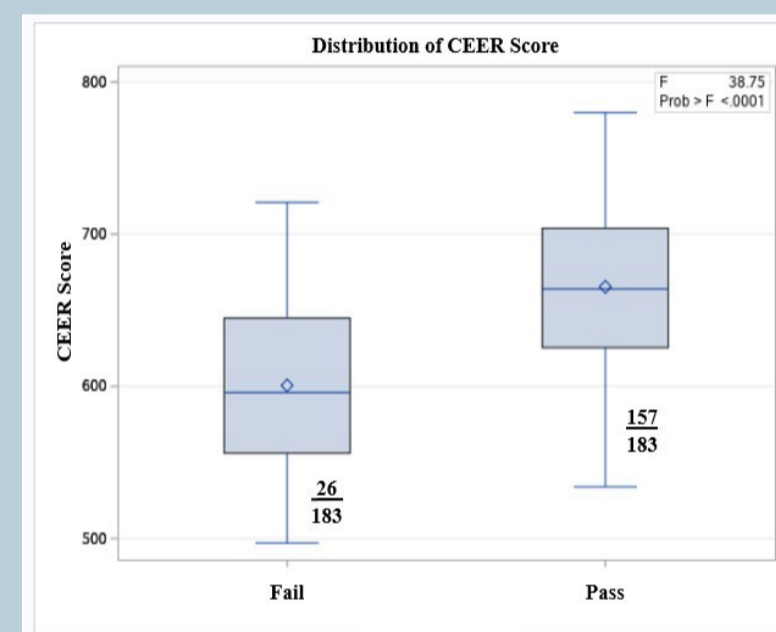


Figure 2. Distribution of CEER scores between Pass/Fail FEE populations.

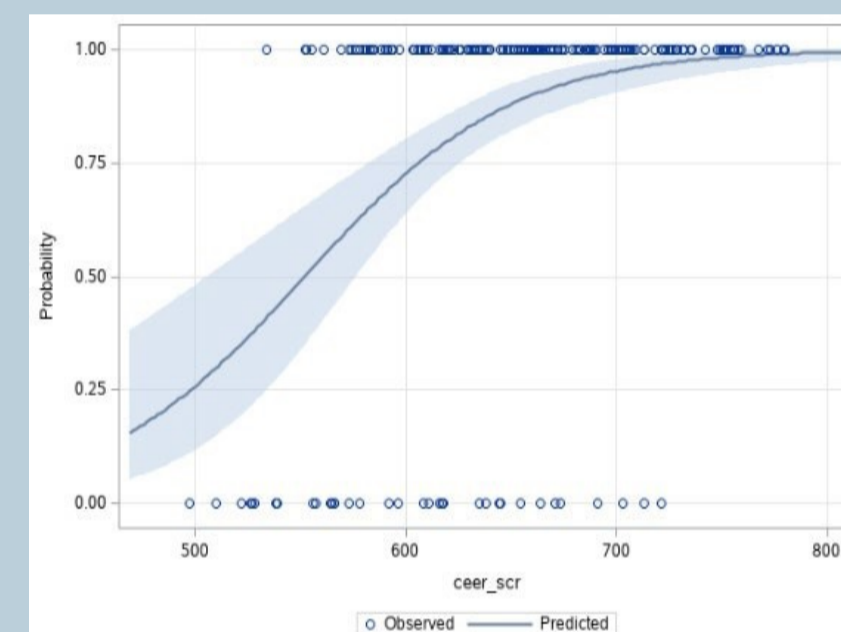


Figure 3. Univariate logistic regression model for success on the FEE. Probability of passing versus CEER score.

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14. Whole Candidate Score Picture. New Admissions Committee Training 16-17. Power Point. January 2019. Amplifying

Amplifying Data

Table 1. West Point Chemical Engineering Program Aggregated Data, 2006 – 2019

Total Chemical Engineering Graduates	215
Total Cadets Declaring Major	267
% of Cadets who Remain in the Major through Graduation	80.67%
Average CEER Score	655 ± 61
FEE Success Rate	83.72%
Average Cumulative GPA	3.37 ± 0.44

Fall Term	Course	Credit Hours	Spring Term	Course	Credit Hours
4th CLASS					
MA103	Math. Modeling & Intro. Calculus	4.5	MA104	Calculus I	4.5
CH101	General Chemistry I	4.0	CH102	General Chemistry II	4.0
EN101	Composition	3.0	EN102	Literature	3.0
HI107	Western Civilization	3.0	HI108	Regional Studies in World History	3.0
TI105	General Psychology	3.0	PE100	General Psychology	3.0
PE11x	Conlatives / Boxing / Movement	0.5	MS100	Introduction to Warfighting Fundamentals/Personal Fitness	1.5
			PE150	Fundamentals/Personal Fitness	1.5
3rd CLASS		Total 18.0			Total 20.5
MA205	Calculus II	4.0	CH262	Mass and Energy Balances	3.5
PH205	Physics I	4.0	MA364/5	Applied Engineering Math	3.0
LS205	Foreign Language	4.0	PE206	Physics II	4.0
SS201	Economics	3.0	LS204	Foreign Language	4.0
PY201	Philosophy	3.0	SS202	American Politics	3.0
MS200	Fundamentals: Army Operations	1.5	EV203	Physical Geography	3.0
			PE 2xx	Lifetime Physical Activity	0.5
2nd CLASS		Total 19.5			Total 21.0
CH262	Separation Processes	3.5	CH264	Chemical Reaction Engineering	3.5
EE301	Fundamentals of Electrical Engineering	3.5	CH367	Introduction to Automatic Process Control	3.0
CH383	Organic Chemistry 1	3.5	MC312	Thermal-Fluid Systems 2	3.0
MC311	Thermal-Fluid Systems 1	3.5	MC300	Fundamentals of Eng. Mech. & Design	3.0
PL300	Military Leadership	3.0	SS300	International Relations	3.0
MA206	Probability and Statistics	3.0	MS300	Platoon Operations	1.5
PE32x	Survival Swimming	0.5	PE360	Combat Applications	1.5
1st CLASS		Total 20.5			Total 15.0
CH459	Chemical Engineering Laboratory	3.5	CH402	Chemical Engineering Process Design	3.5
CH365	Chemical Engineering Thermodynamics	3.0	CH400	Chemical Engineering Prof. Practice	1.5
CH485	Heat & Mass Transfer	3.5	EL300	Elective Engineering Elective 3	3.0
EL300	Elective Engineering Elective 1	3.0	HI302	History of the Military Art	3.0
EL300	Elective Engineering Elective 2	3.0	LW403	Constitutional & Military Law	3.0
MA450	Army Fitness Development	1.5	MX400	Officership	3.0
		Total 17.5			Total 17.0

Figure 4. Eight Term Academic Program for Chemical Engineering Majors at West Point