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An Investigation into Persistence and Nonpersistence of Second and Third Year Engineering Students

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By: Kim Ball

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“Quiet Crisis”

“We simply cannot sustain an economy based on innovation unless our citizens are educated in mathematics, science, and engineering.” – Bill Gates

“Quite Crisis: The steady erosion of America's scientific and engineering base which has long been the source of American innovation and our rising standard of living (*Is America Falling Off the Flat Earth*, 2007)

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2nd and 3rd Year Nonpersistence

- Research Questions:
  - Which factors are associated with students' persistence in engineering during their second and third years in school?
  - Why do some students persist in engineering while others comparable on the same factors do not persist?
  - What can institutions do in order to increase persistence in engineering programs?

Theoretical Framework

- Tinto's Model of Institutional Departure (1993) - Students must integrate into:
  - Formal academic systems
  - Formal social systems
  - Informal social systems
- Many researchers today categorize these systems into two distinct factors:
  - Individual factors
  - Institutional factors

STEM and Engineering Nonpersistence: Individual Factors

- **GPA**
- Gender
- Ethnicity
- **ACT/SAT math**
- **Calculus/physics grades**
- Work 20+ hours / week
- **Inadequate high school preparation**
- Overwhelmed
- Effort not worth it
- Poor study skills
- **Failure of courses**
- **Don't seek help (tutor)**
- Sense of loss and failure
- Disappointment in field
- **Unprepared for rigor**
- **Unprepared for time commitment**
- Low motivation
- Too few role models
- Feelings of not belonging
- Easy to transition to new major
- **Financial concerns**
- Perceived discrimination
- Peer relationships

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STEM and Engineering Nonpersistence: Institutional Factors

- **Takes longer to graduate**
- No career counseling
- Poor academic counseling
- Poor relationship between student and advisor
- **Poor relationship between student and professor**
- No institutional support
- **Weed-out culture (gateway courses)**
- Curriculum – structure, sequence
- **Inadequate advising**
- Poor mentoring
- Poor teaching
- Too few role models
- Time commitment not mentioned
- Don’t encourage social interaction between students
- **Unwelcoming culture**
- **Isolated in field**

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Mixed-Methods Approach

- Quantitative
  - Descriptive Analysis
  - Predictive Discriminant Analysis
    - Individual and Institutional variables
- Qualitative
  - Interviews and documents
  - 10 students who have not persisted and 10 students who have persisted.

Site for the Study

- A mid-size Southern research university that is ABET (Accreditation Board for Engineering and Technology) accredited

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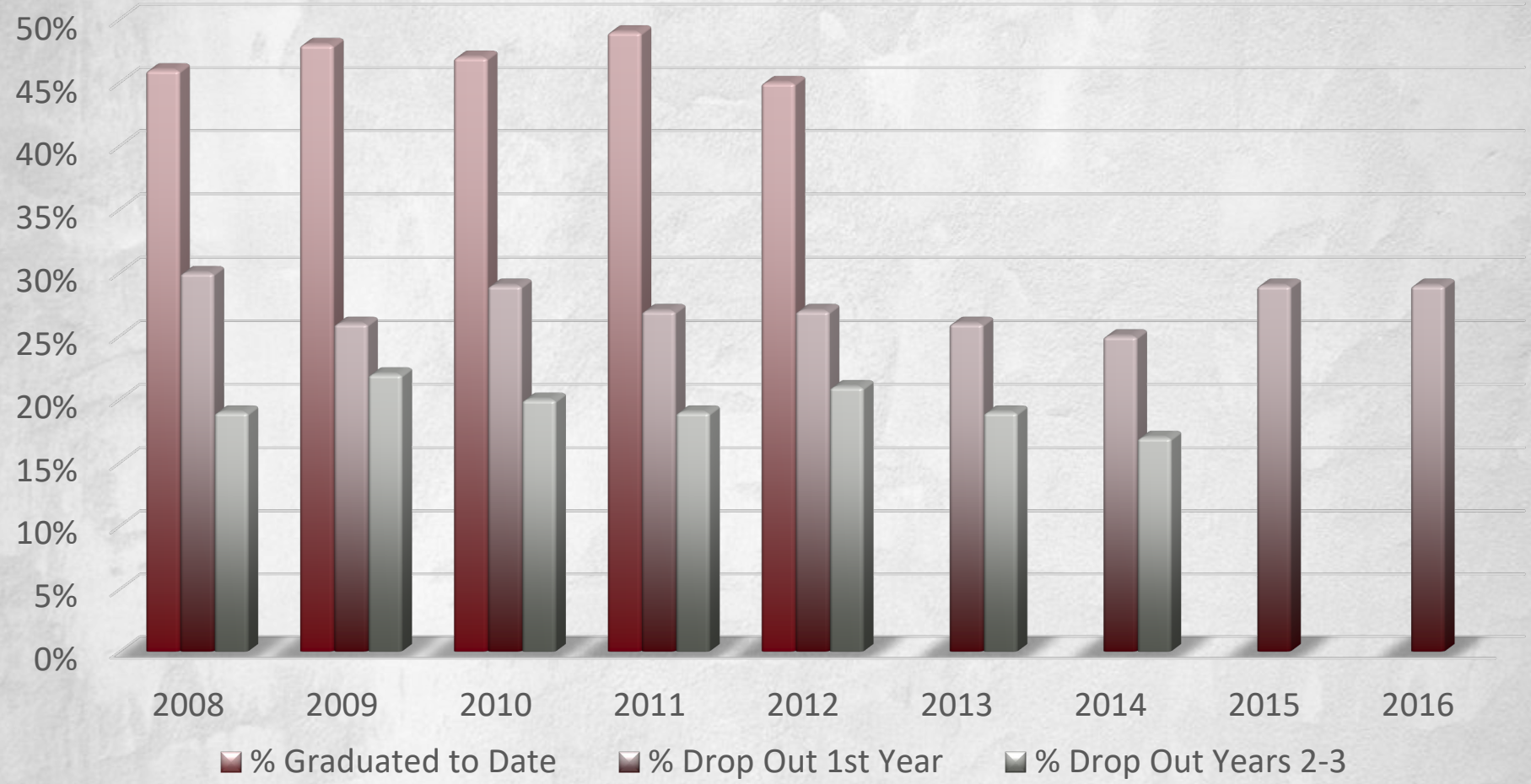
Graduation and Nonpersistence Rates - MSU Engineering Students (Data provided by MSU's Office of Institutional Research)



% Graduated to Date by Year ≈ 47%

% Nonpersisters 1st year ≈ 28% **% Nonpersisters 2nd and 3rd year ≈ 20%**

Quantitative Portion

- Population:
  - Engineering undergraduates who began as a freshman in summer or fall 2014, separated into three groups:
    - Students who did not persist to Fall 2015 (First year nonpersisters)
    - Students who left engineering Spring 2016 – Summer 2017 (Second- and Third-Year Nonpersisters)
    - Students who persisted through Fall 2017 (Persisters)
  - 714 students
  - 552 males (77%) & 162 females (23%)
  - 577 white (81%), 79 black (11%), and 58 other ethnicity (8%)
- Data provided from:
  - Mississippi State University's Office of Institutional Research

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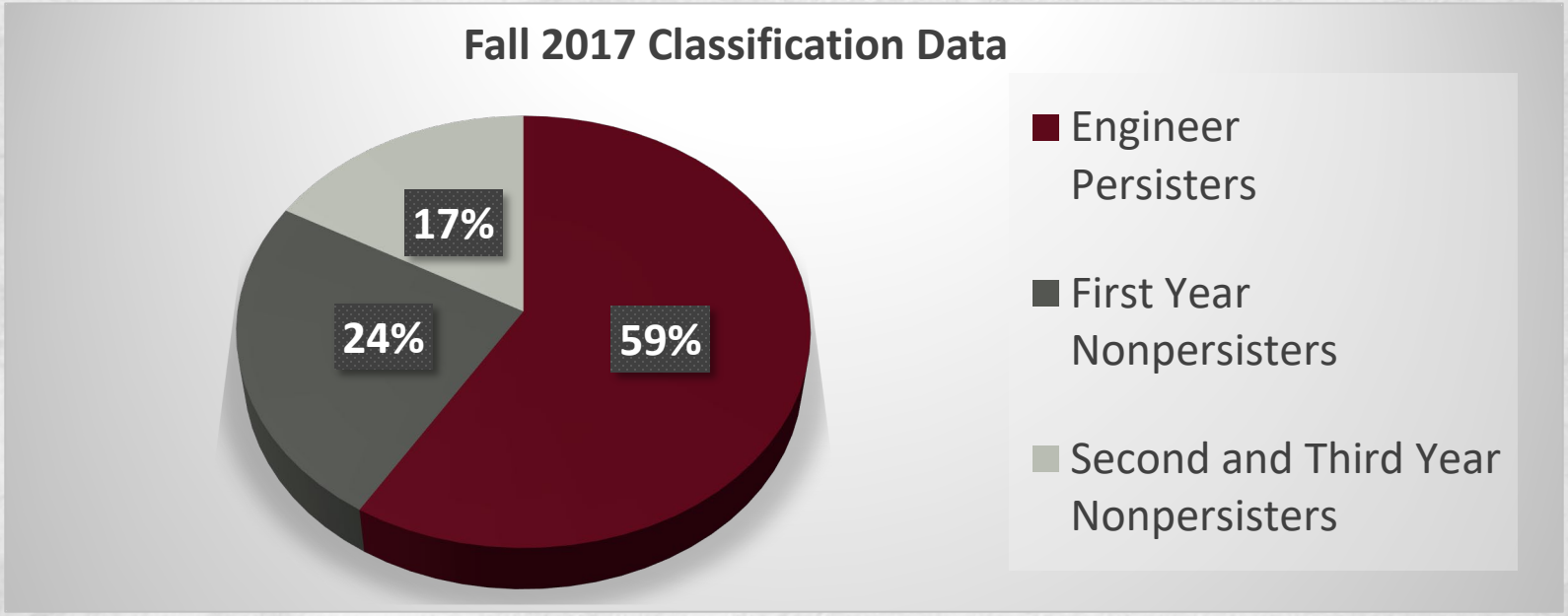
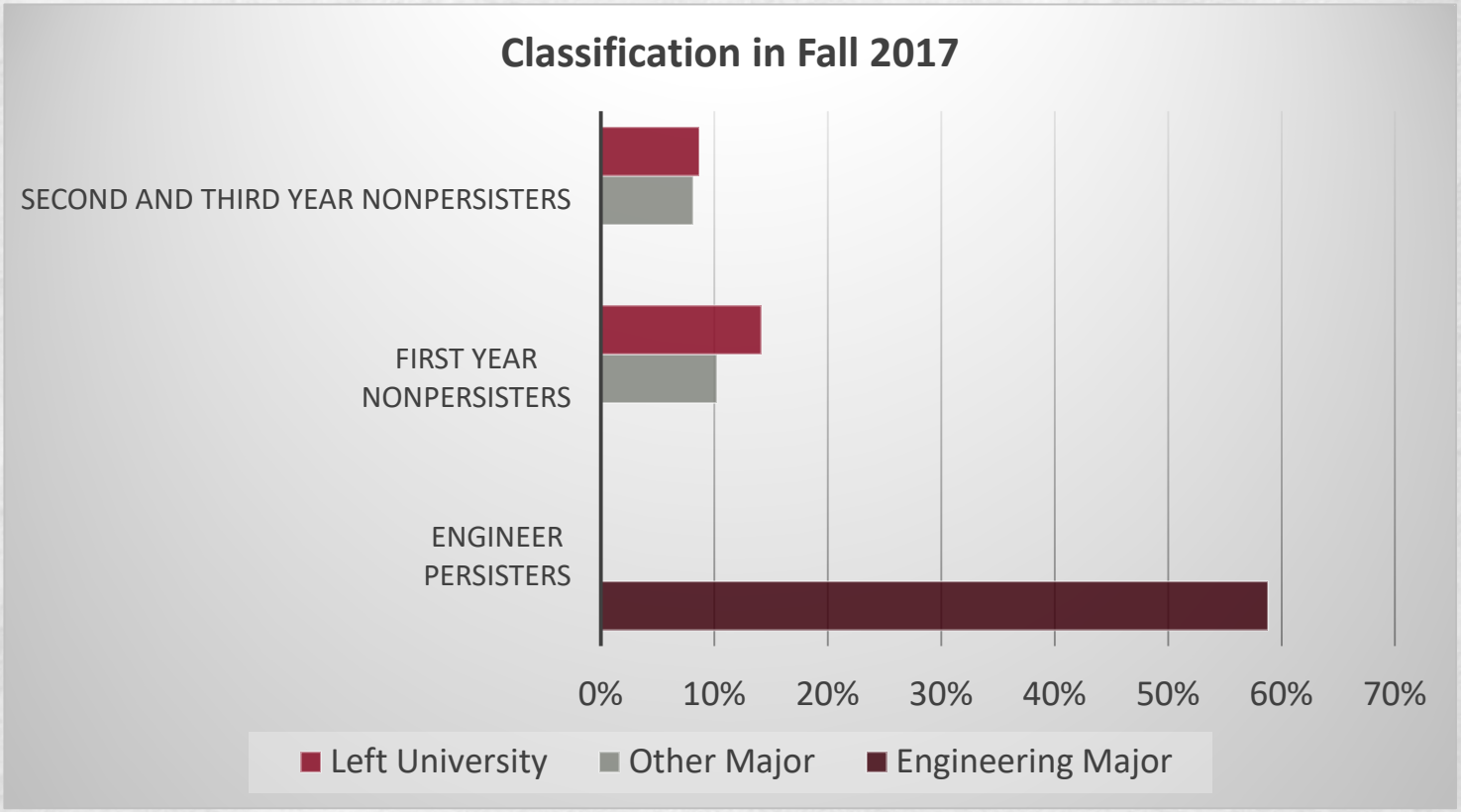
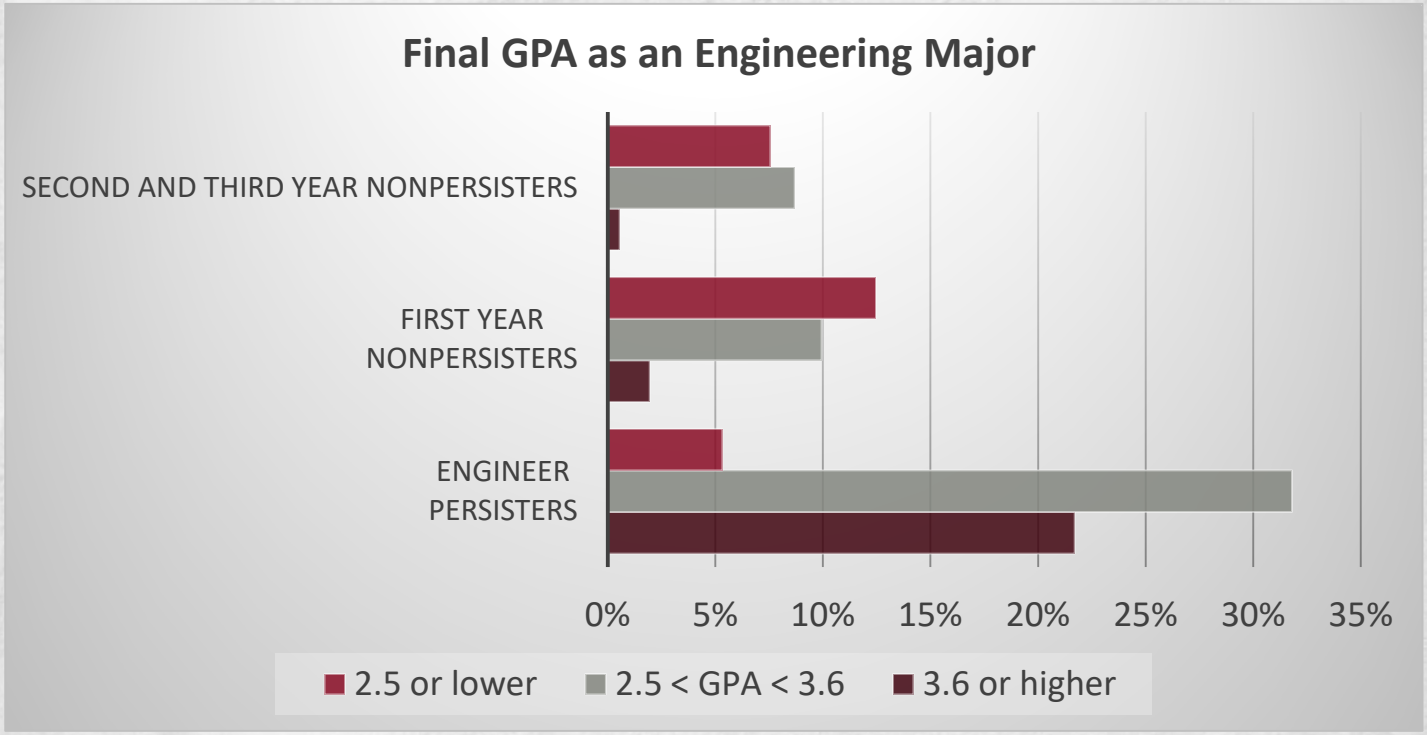
Year 4 Classifications



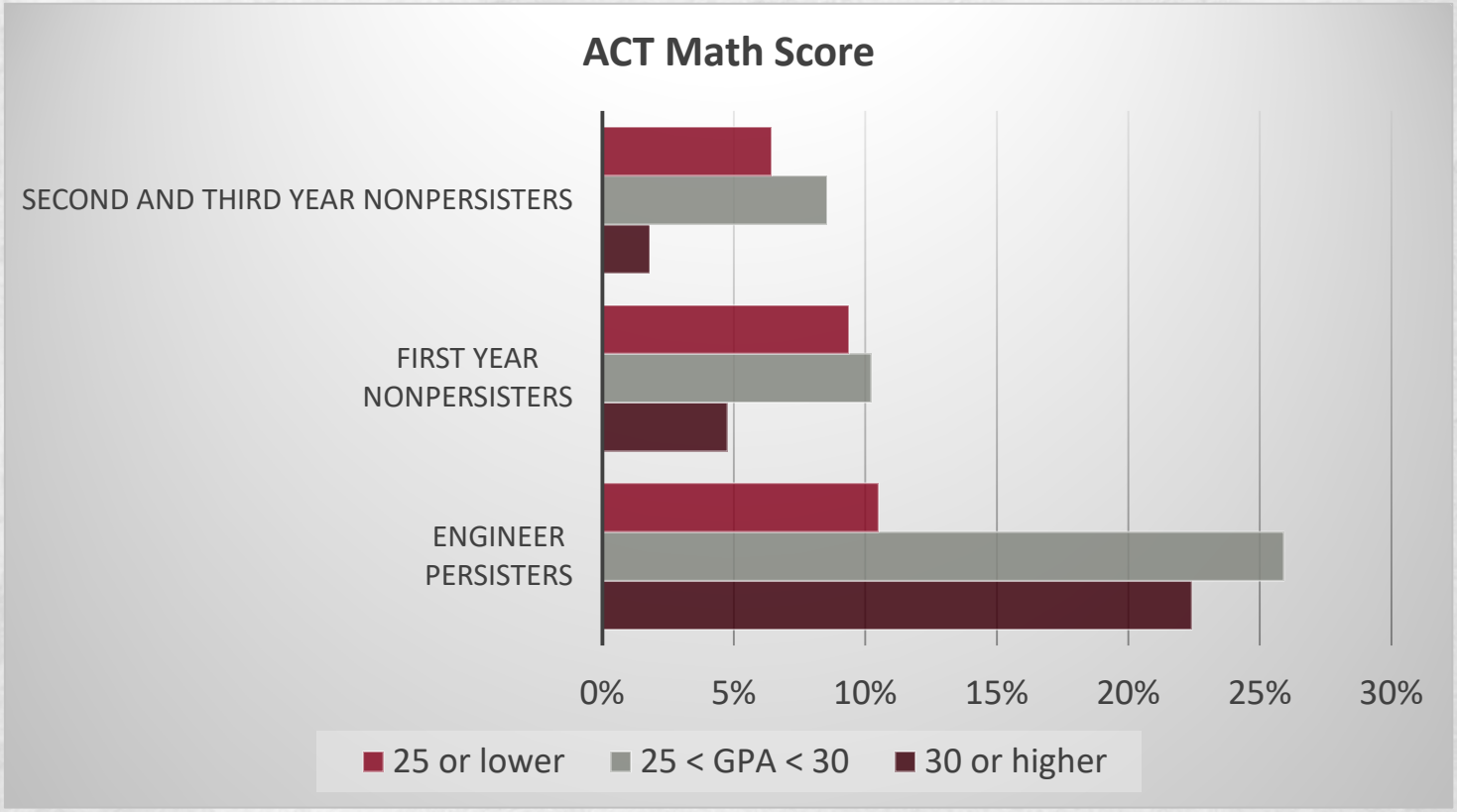
Year 4 Classifications



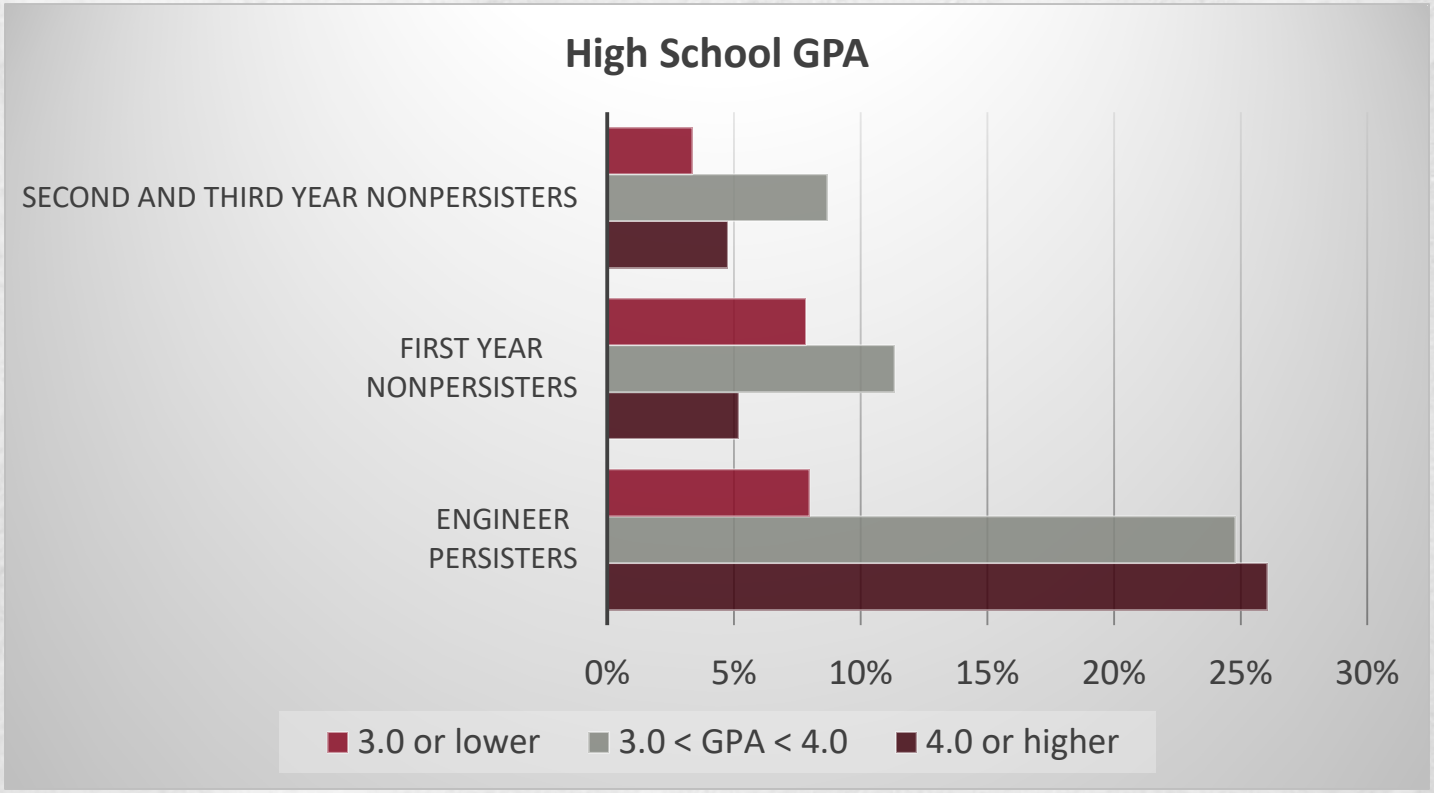
GPA Classifications



ACT Math Score Classifications



HS GPA Classifications

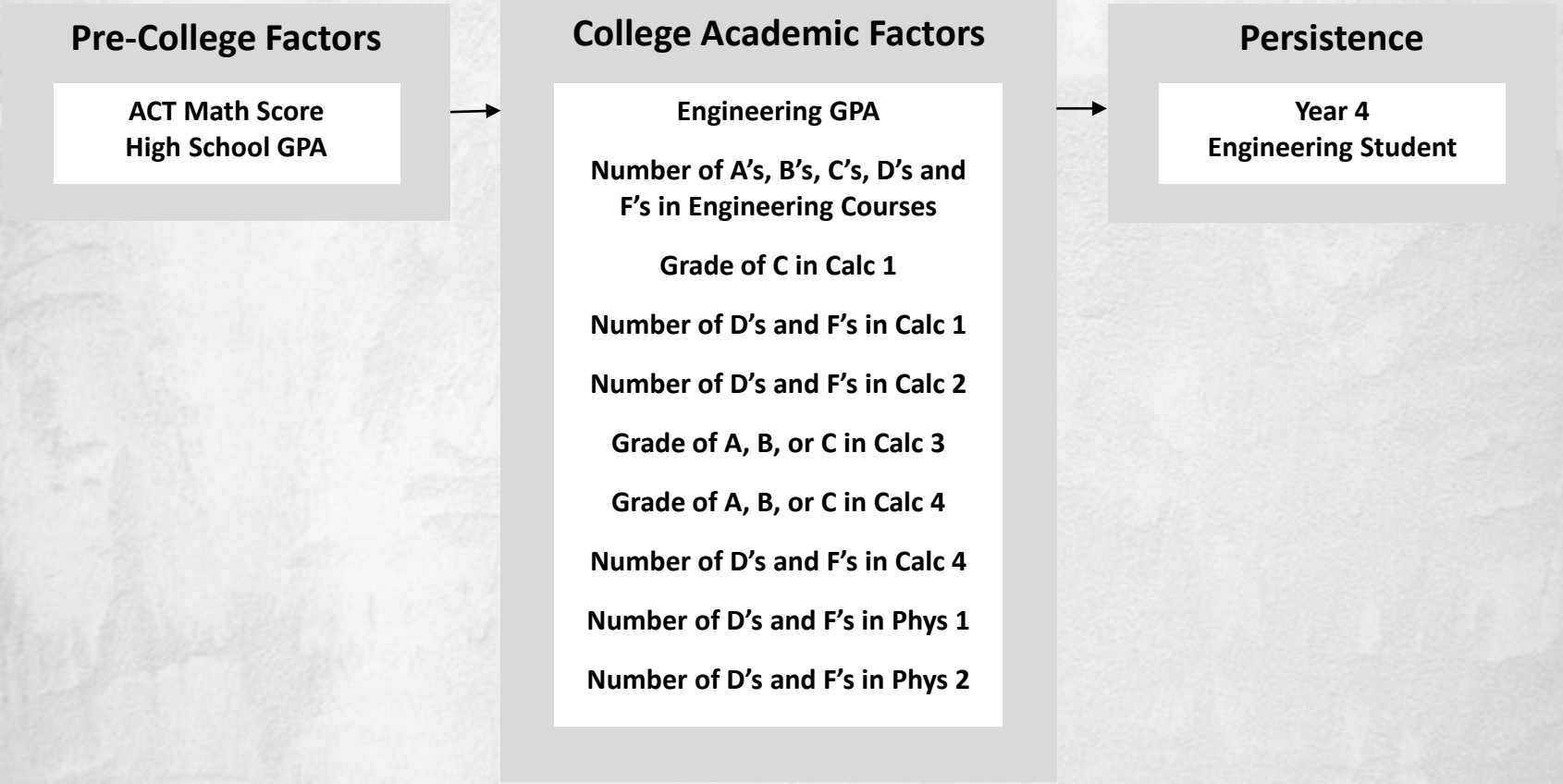


Discriminant Analysis

Classification Results		
	Predicted Engineer Persisters	Predicted Second and Third Year Nonpersisters
Actual Engineer Persisters	96.2%	3.8%
Actual Second and Third Year Nonpersisters	7.5%	92.5%

Variables Input into the Analysis:
Math ACT Score, High School GPA, Grade of A, B, or C in Calculus 1-4
Grade of A, B, or C in Physics 1-2, Number of D's and F's in Calculus 1-4
Number of D's and F's in Physics 1-2, Number of A's – F's in Engineering Courses
Final GPA as an Engineering Major

Second- and Third- Year Engineering Persistence Model



Qualitative Questions

See Handout

Questions or Comments?

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