

# The Influence of Demographics on an Introductory Circuits Course

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# Presentation Outline

Introduction

Methods of Evaluation

Results

Conclusions

# Introduction

- Explores the performance of engineering students in DC circuit analysis during the 2000 through 2003 school years
- Evaluates final course grade (quantitative data) based upon
  - Gender
  - Race
  - Major
  - Classification
  - Requisite performance
  - Course Repeats

# Introduction (cont.)

- Majors included
  - Civil
  - Architectural
  - Mechanical
  - Electrical
- Classifications included
  - Sophomore
  - Junior
  - Senior
  - Graduate
- Prerequisites included
  - Physics II
  - Calculus IV
  - Programming
- Co-requisites included
  - Applied Mathematics
  - Circuits Laboratory



# Introduction (cont.)

## Course Description

- Lecture-style (traditional) format
- Introduces problem solving methodology and critical thinking
- Approximately 30 students per class
- 3 major projects (PSpice, programming)
- Course content includes:
  - Ohm's Law
  - Nodal and Mesh Analysis
  - Thevenin's and Norton's Theorems
  - Operational Amplifiers
  - First-order and Second-order Circuits

# Introduction (cont.)

## Hypothesis

Student demographics may be a predictor of student success in DC circuit analysis as well as retention in engineering

# Methods of Evaluation

Data collected from Fall 2000 to Spring 2003 included:

- Race
- Gender
- Classification
- Major
- Final course grade
- Number of repeats
- Pre-requisite grades

# Methods of Evaluation (cont.)

- Small sample size ( $n \sim 300$ )
- Abnormal distribution of data
- Non-parametric tests
- Significant difference ( $p\text{-value} = .05$ )
- Possible trend ( $p\text{-value} = .10$ )



# Methods of Evaluation (cont.)

- Mean grade in the course was evaluated using statistical software (SPSS) based upon the aforementioned criteria
- Data collected from Fall 2000 – Spring 2003 included:
  - Race
  - Gender
  - Classification
  - Major
  - Final course grade
  - Number of repeats
  - Pre-requisite grades



# Results

## Student Records

324 student records evaluated

Withdrawals	28
Course taken once	254
Course taken twice	3
Course taken thrice	38
Course taken four times	1
Average # of course attempts	1.35



# Results (cont.)

## Gender



Letter Grade	Female	Male	Total
A	7	24	31
B	26	40	66
C	49	72	121
D	15	31	46
F	7	25	32
Total	104	192	296
Grade point	2.11	2.04	2.06



# Results (cont.)

## Race

Letter Grade	Asian	Black	Hispanic	White
A	1	22	2	6
B	1	57	0	8
C	3	113	0	5
D	0	46	0	0
F	1	29	0	2
Total	6	267	2	21
Grade point	2.17	1.99	4.00**	2.76**

\*\*5% level of significance

# Results (cont.)

## Classification

Letter Grade	SO	JR	SR	MS	Other
A	2	16	11	2	0
B	10	36	19	0	1
C	10	69	42	0	0
D	4	22	20	0	0
F	7	16	9	0	0
Total	33	159	101	2	1
Grade point	1.88	2.09	2.03	4.00**	3.00

\*\*5% level of significance

# Results (cont.)

## Major

Letter Grade	AE	CE	EE	ME	CISE	Other
A	3	1	18	6	2	1
B	8	7	34	14	0	3
C	31	6	54	29	0	1
D	10	4	23	8	0	1
F	7	2	15	8	0	0
Total	59	20	144	65	2	6
Grade point	1.83	2.05	2.12*	2.03	4.00**	2.67

\*10% trend

\*\*5% level of significance

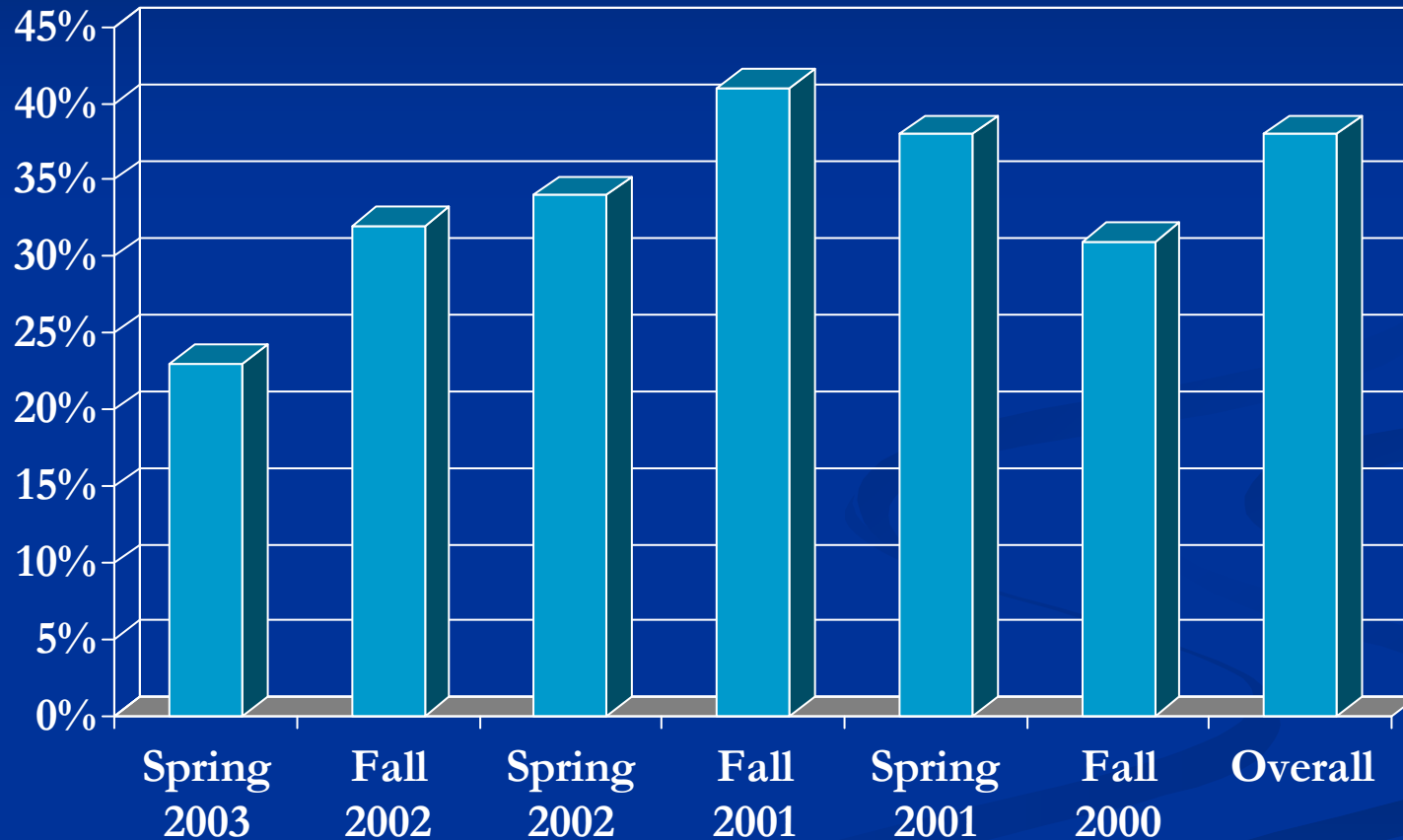
# Results (cont.)

## Course Repeats

Letter Grade	1	2	3	4	5
A	24	7	0	0	0
B	54	8	2	2	0
C	81	33	6	0	1
D	32	13	1	0	0
F	24	3	3	1	1
Total	215	64	12	3	2
Grade point	2.10	2.05	1.58	2.00	1.00

# Results (cont.)

## Attrition Rate

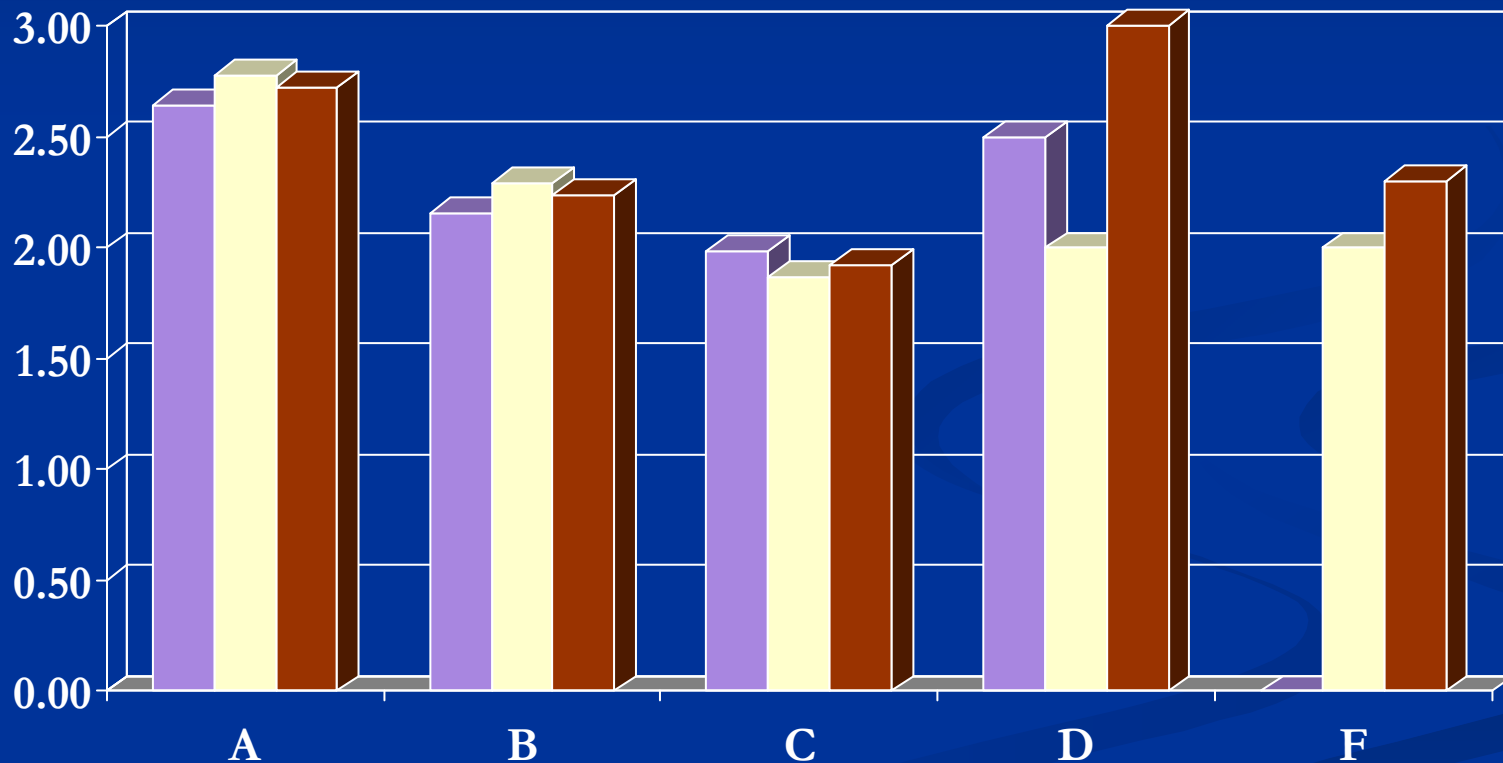




# Results (cont.)

## Pre-requisites

■ Calculus\*\* ■ Physics\*\* ■ Programming\*\*



\*\*5% level of significance

# Conclusions

- The mean course attempts were 1.35
- The mean course grade point was 2.06 (C average)
- The attrition rate for the course was 33%
- Caucasian and Hispanic students performed the best in the course
- Graduate students performed the best in the course
- Electrical Engineering majors performed the best in the course
- The pre-requisite grades had a positive correlation with the final circuits course grade

# Conclusions (cont.)

- The results indicate that course success may be improved by redesigning it to include active learning activities
- Aforementioned student demographics along with other criteria may be used for team formation in the new active circuits course
- Future work would also include a comparison of the traditional circuits course to the active learning format to identify any significant difference

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