Intersession 2016 Assessment Institute

Assessment of Low Retention in the Physics/EE Department: Implemented Changes and Results

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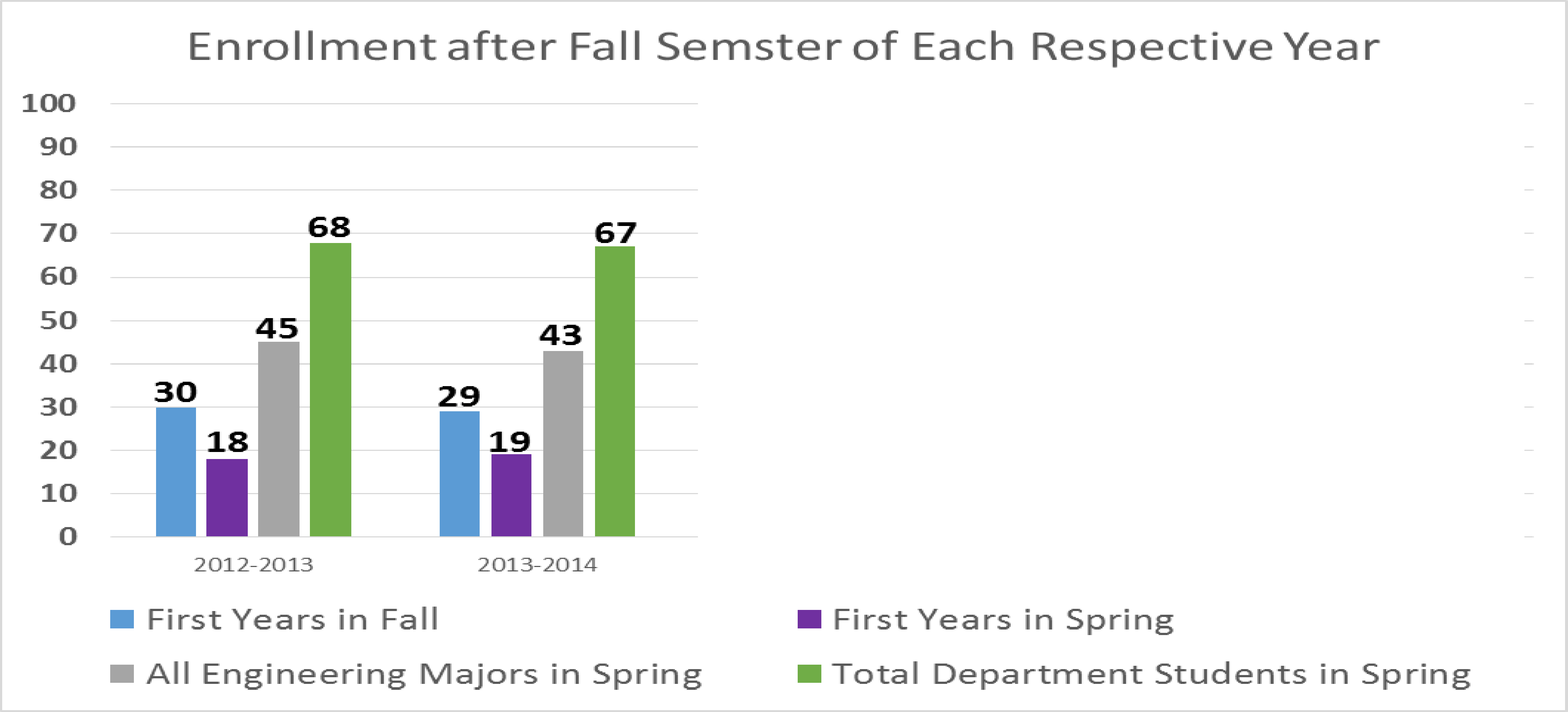
Changes over the years…

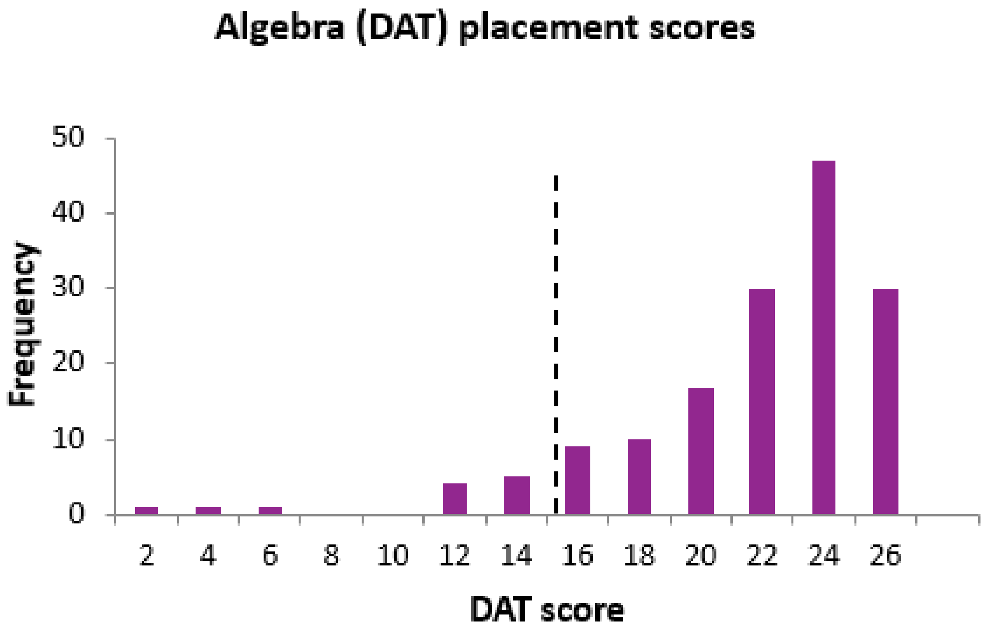


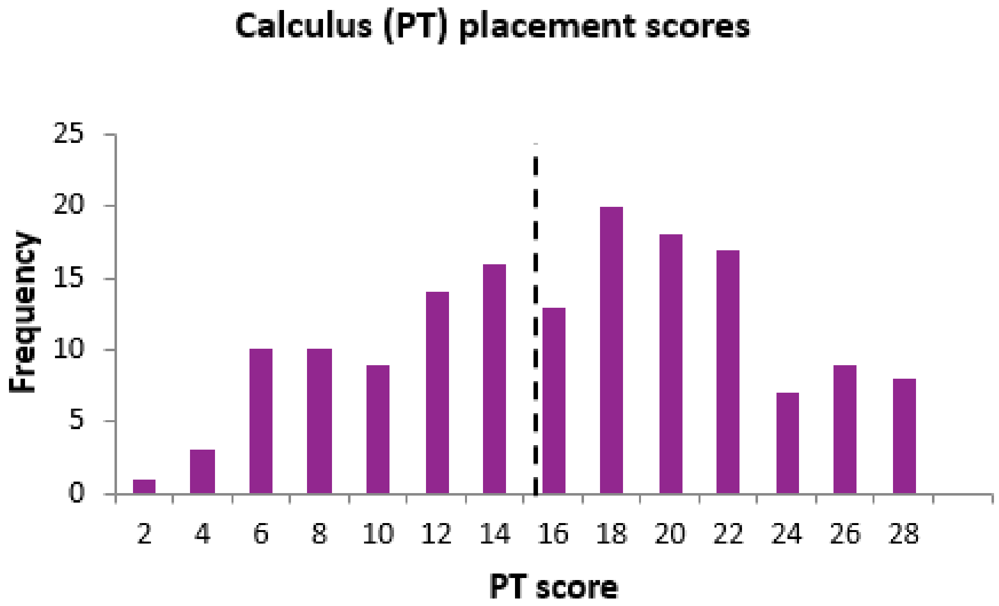
Changes over the years…

- Institution
  - Curriculum modifications
    - Public speaking requirement
    - Computer literacy requirement
    - First year seminar change
  - Middle States warning
  - The year of declined enrollment
- Department Observations
  - **Relaxed math pre/co-requisites** placing all first year department majors into PHYS 140 – Elements of Physics I their first semester
  - Incoming cohorts of **students seem disconnected from department and each other**
  - First Physics program review in…….”memorable history”

2013-2014 Department Retention Study

- …..we discovered that by the end of the fall semester, we lose about 39.1% of our initial incoming majors, and then we lose 52.2% of our incoming majors by the end of their first academic year…..





Across four sections of PHYS 140 over three academic years totaling 113 students

2013-2014 Department Retention Study

	DAT/26	SAT Math	SAT Verbal	HS GPA	Exam 1	Course Grade
PT ≤ 14/28	$\bar{x}$ = 17.8 s^2 = 20.8	$\bar{x}$ = 565 s^2 = 3011	$\bar{x}$ = 552 s^2 = 2528	$\bar{x}$ = 3.18 s^2 = 0.10	$\bar{x}$ = 59.2 s^2 = 253	$\bar{x}$ = 58.7 s^2 = 306
PT > 14/28	$\bar{x}$ = 23.0 s^2 = 11.5	$\bar{x}$ = 661 s^2 = 5193	$\bar{x}$ = 599 s^2 = 5589	$\bar{x}$ = 3.62 s^2 = 0.12	$\bar{x}$ = 75.5 s^2 = 267	$\bar{x}$ = 78.1 s^2 = 278

Every column/metric in the table shows a statistically significant difference between groups only based on PT calculus score.

This indicates that using the PT calculus math placement score is probably a good discriminating variable. There are no claims about why the groups are different.

Implementation #1

- The natural next step would be to enforce the math prerequisites for introductory physics
- Enforce outcome of math placement exam
  - If PT score < 14, start with chemistry and hold off on intro physics until spring semester of first year, place in MATH 103 – Pre-Calculus
  - If PT score > 14, start with intro physics and place in MATH 114 – Calculus or higher
- Effect of enforcement is a trailing physics course sequence!
- This could possibly address issues pertaining to student performance in intro physics causing our retention issues, but this is <u>most likely not the cause</u> of the disconnect between our students and the department
- What else could be done?

Implementation #2

The Eloquentia Perfecta (EP) Initiative

- In order to replace public speaking and computer literacy courses, programs/departments had three options:
  - Take an interdisciplinary EP course taught by public speaking and computer literacy faculty
  - Show that an existing introductory course in your program meets the EP requirements
  - Create a new course highlighting the EP requirements in addition to other program objectives

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PHYS/ENGR 150 (FYOC, FYDT)
Foundations of Physics and Engineering

- Description
  - This physics and engineering ***cornerstone*** course will cover foundational topics including science and information literacy, basic computer programming, micro-processing, and professional ethical standards. After completing the course, the student will progress toward proficiency in oral communication skills and the use of digital technology through assignments and projects relevant to the physicist and engineer.

First administration was Fall 2014 with 24 first year students majoring in physics, electrical engineering, computer engineering, and engineering management

PHYS/ENGR 150 (FYOC, FYDT)
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“Hidden” program learning outcomes

PHYS/ENGR 150 (FYOC, FYDT)
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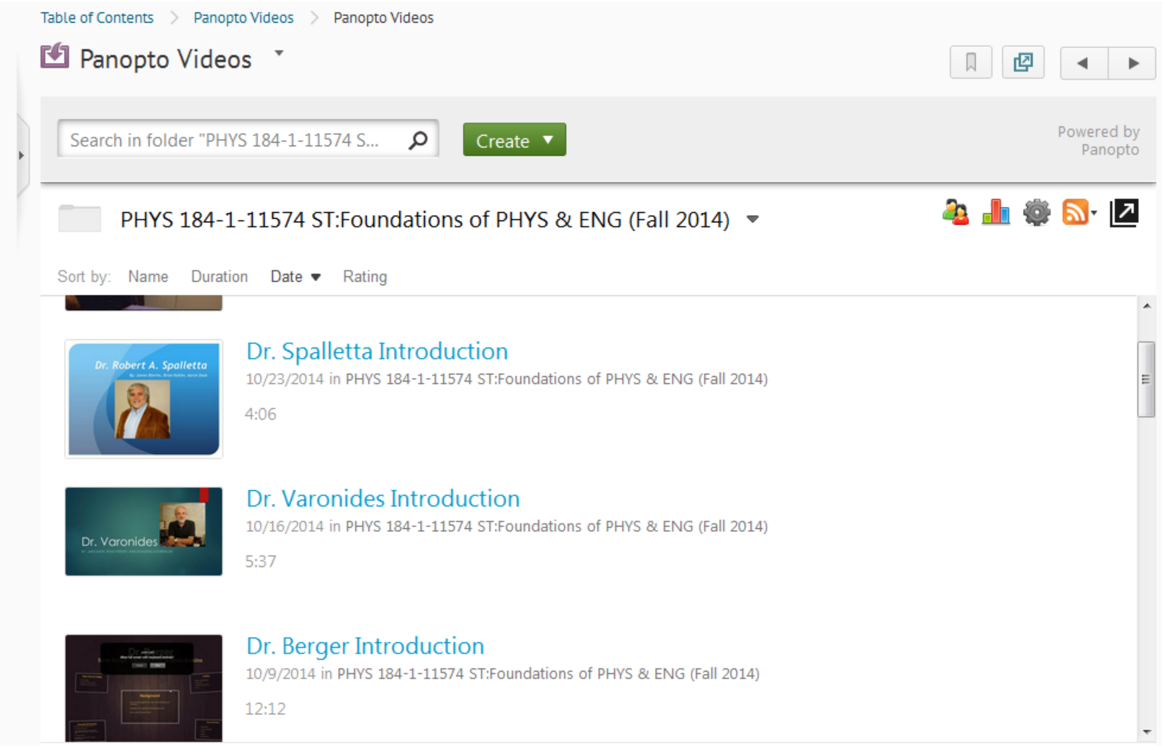
Vehicle to learn about and meet the department faculty and students



PHYS/ENGR 150 (FYOC, FYDT)
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Meet the EP Student Learning Outcomes (SLOs)

EP Level I: First-Year Digital Technology (FYDT) - Student Learning Outcomes

- Conduct effective search strategies to gather information suitable to the topic, audience, purpose, context, and speaker
- Evaluate sources for credibility
- Use digital technology to analyze and process data and information
- Employ digital technology to deliver results in appropriate forms

EP Level I: Oral Communication (FYOC) - Student Learning Outcomes

- Structure and organize information according to purpose, audience, and situation
- Develop and share ideas in both formal and informal situations using verbal and non-verbal communication
- Create and maintain a relationship between the speaker and audience
- Engage in effective listening and self-reflection

PHYS/ENGR 150 (FYOC, FYDT)
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EP SLO Assessment Process

- IEEE Code of Ethics Presentation
  - Used the same IEEE rubric as regional student competition
  - Linked IEEE rubric items to EP SLOs
  - Set benchmarks for each criterion of rubric
  - Performed quantitative analysis looking at statistics and data variability of student performance
  - Propose an action if necessary

(EP) PHYS/ENGR 150
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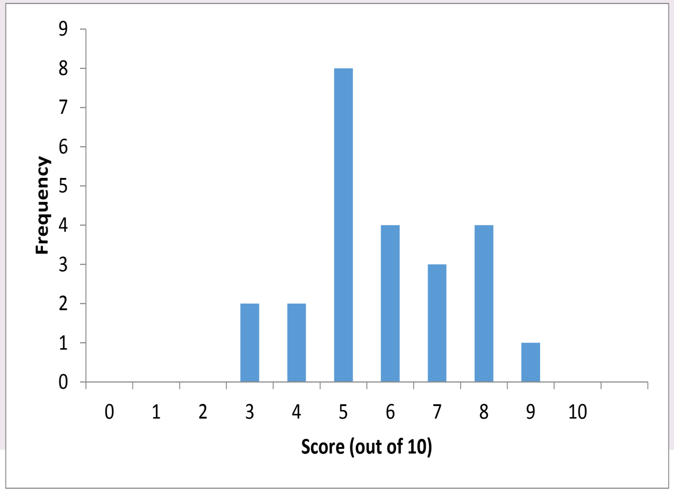
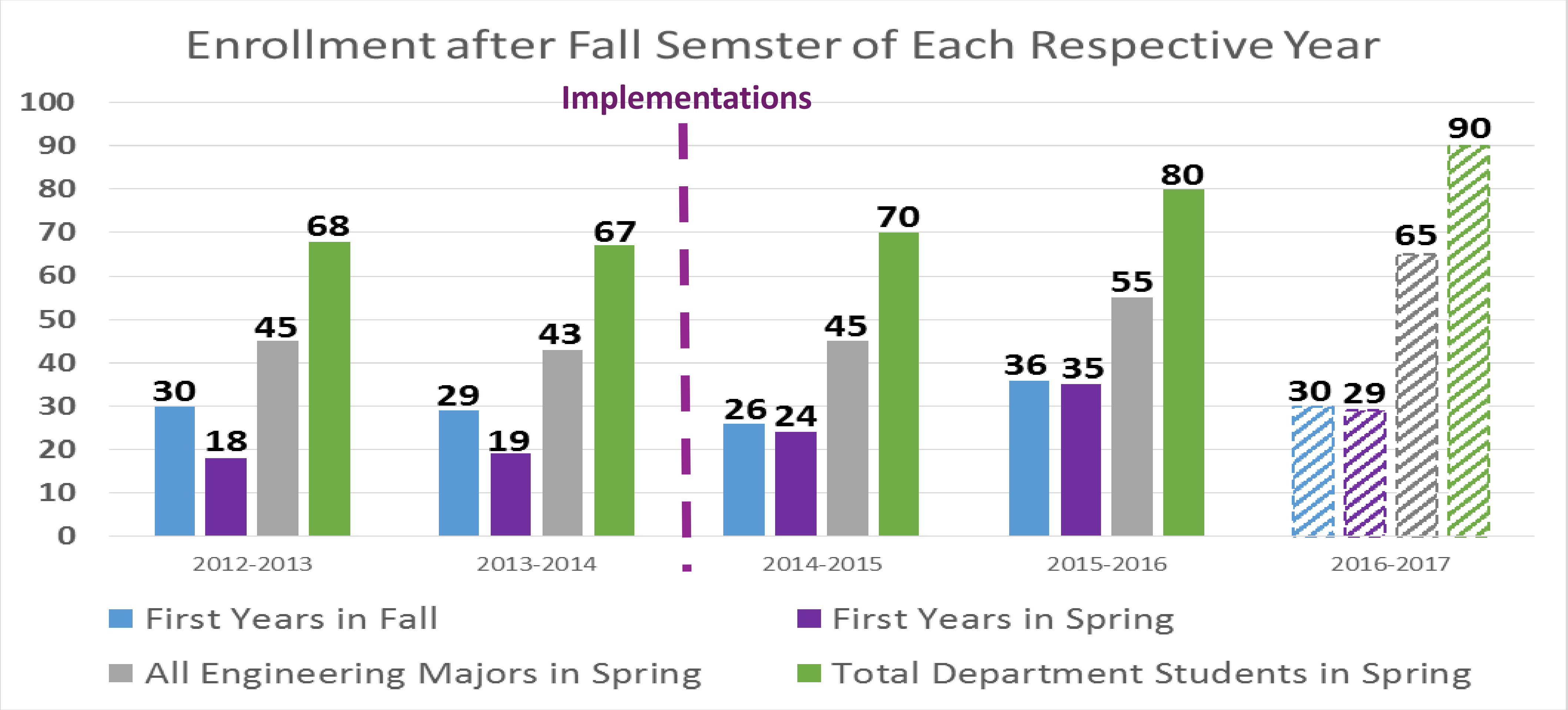
IEEE Code of Ethics Rubric Item	SLO Link	Max Score	Assessment: N=12 student groups of two Benchmarks 2.5/5 for 5 point max, and 5/10 for 10 point max.	Proposed Actions
Case Facts – restatement of relevant facts pertinent to the ethical case from the given prompt	FYOC - 2	5	**Mean= 4.8 with σ = 0.33, Mode*=5, Minimum=4** Two thirds of groups achieved the maximum score of 5 with the lowest score of all groups a 4. All groups were able to share the information from the ethical case prompt at a high level	None
Questions – restatement and summary of posed ethical questions	FYOC - 2	10	**Mean = 2.2 with σ = 3.95, Mode=0** 75% of groups received a score of 0. The other 25% received scores of 8, 8, and 10. A large majority of the groups must not have understood that they had to summarize the posed questions in their own words and not just simply "restate" as the rubric shows.	Change the description of the item on the rubric so it is more clear on the information wanted/required
References – identification of relevant sections from code, reasoning and analysis	FYDT - 1 FYDT - 2	5	**Mean = 3.6 with σ = 0.64, Mode = 4, Minimum=2** All groups but one met the benchmark with low variability in the scores. Generally the groups were able to effectively gather information suitable to the ethical prompt and choose the correct ethical codes to make their case credible	None

(EP) PHYS/ENGR 150
Foundations of Physics and Engineering

IEEE Code of Ethics Rubric Item	SLO Link	Max Score	Assessment: N=12 student groups of two Benchmarks 2.5/5 for 5 point max, and 5/10 for 10 point max.	Proposed Actions
Organization and Clear conclusion – overall organization and quality of conclusion	FYOC - 1	5	**Mean = 2.8 with σ = 1.33, Mode = 2** 58% of the groups met the benchmark. The mode of 2 can be attributed to the number of groups (4 groups, which is one third of total) that simply did not have a conclusion at all. For some reason, these groups did not include a conclusion in the structure of their presentation.	Although the mean shows a majority meeting the benchmark, more time will be spent discussing the importance of a conclusion.
Communication Effectiveness – delivery and power point quality including terminology, appearance, voice, use of visuals, etc.	FYDT - 4 FYOC - 3	10	N=24, there was a rubric line item for each student **Mean = 5.8 with σ = 1.60, Mode=5** The histogram shows an expected fairly tight distribution around the mean. Lower grades, specifically a sixth of the students receiving less than 5, can be attributed to their delivery to the judges during the presentation. Although these students improved throughout the semester, relative to the difficulty level of competition, they received lower scores. 	Although the means shows a majority meeting the benchmark, more time will be spent on the proper delivery of persuasive information and the relationship maintenance between speaker and listener.

Results of Implementations?



Thank you!
Comments and Questions???