

Analyzing First Year in College and Transfer Engineering Students in Order to Increase Graduation Rates

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Overview

Engineering Students

- FTIC Retention/Graduation
- FTIC – Survival Analysis
 - Life Tables
 - Findings
 - Program Changes
- Transfer AA – Retention/Graduation
- Transfer AA – Cluster/Discriminant Analysis
 - Findings
 - Program Changes
- Summary



Engineering Students

Low FIU GPA

Travel time to campus

Just started a full-time job

Visa Expiring

FIU math grades are poor

Didn't transfer with
courses needed

75% DO NOT CHANGE MAJOR

Poor High School GPA

Any other unexpected surprises

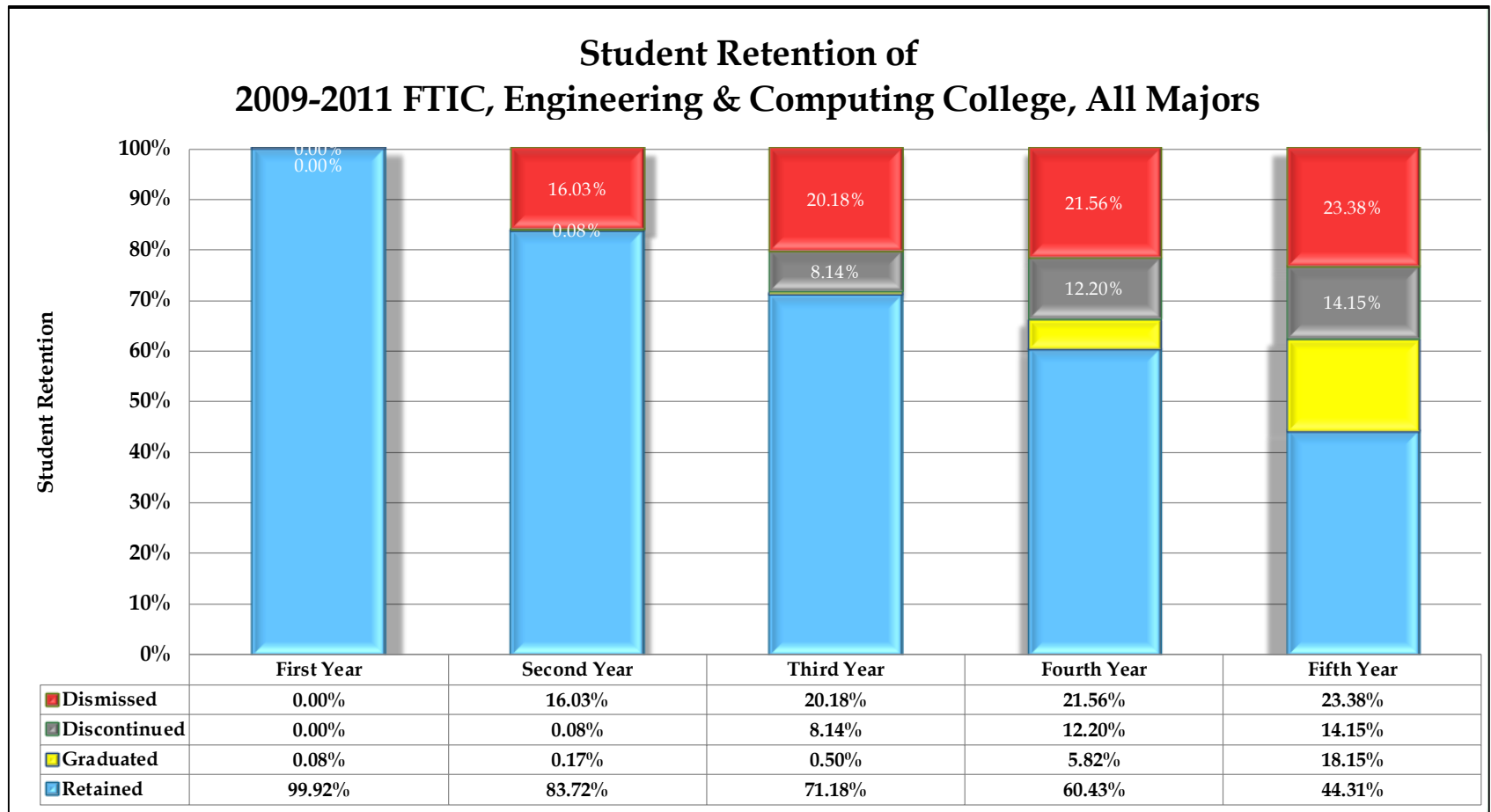
Need more tutoring/proper tutors

Did not transfer with the right courses

My home is in foreclosure

Engineering FTIC Students

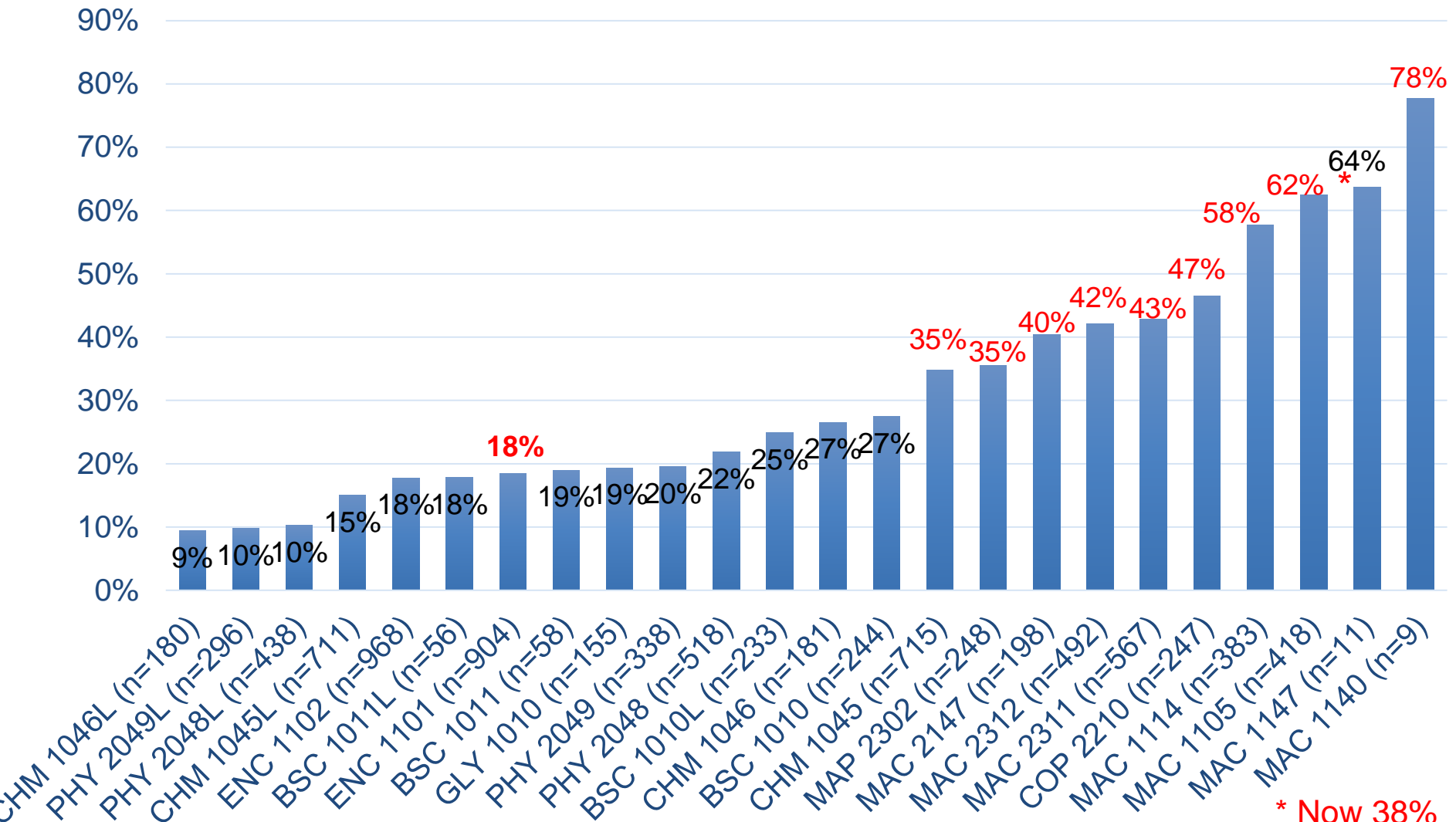
- 1, 204 Students



Engineering FTIC Students

- Does the passing or failing of critical courses predict retention or graduation?
- At what **point in time** are students at the highest risk to discontinue or be dismissed based on their pass and fail rates of critical courses?

Engineering FTIC Students



* Now 38%

Engineering FTIC Students

- Survival Analysis – through 13 semesters (includes summer)
- Life Tables
- Kaplan Meier and Cox Regression (Log-Rank and Wald significance testing)

Overall Findings

- Students who are unsuccessful in critical courses **but remain** in Engineering are at high risk of dropout.
- **57%** of the 2009 FTIC Cohort (n=279) who did not change majors were still enrolled at semester 13 compared to **84%** (n=86) of those who transferred to another college at FIU.

Overall FTIC Findings

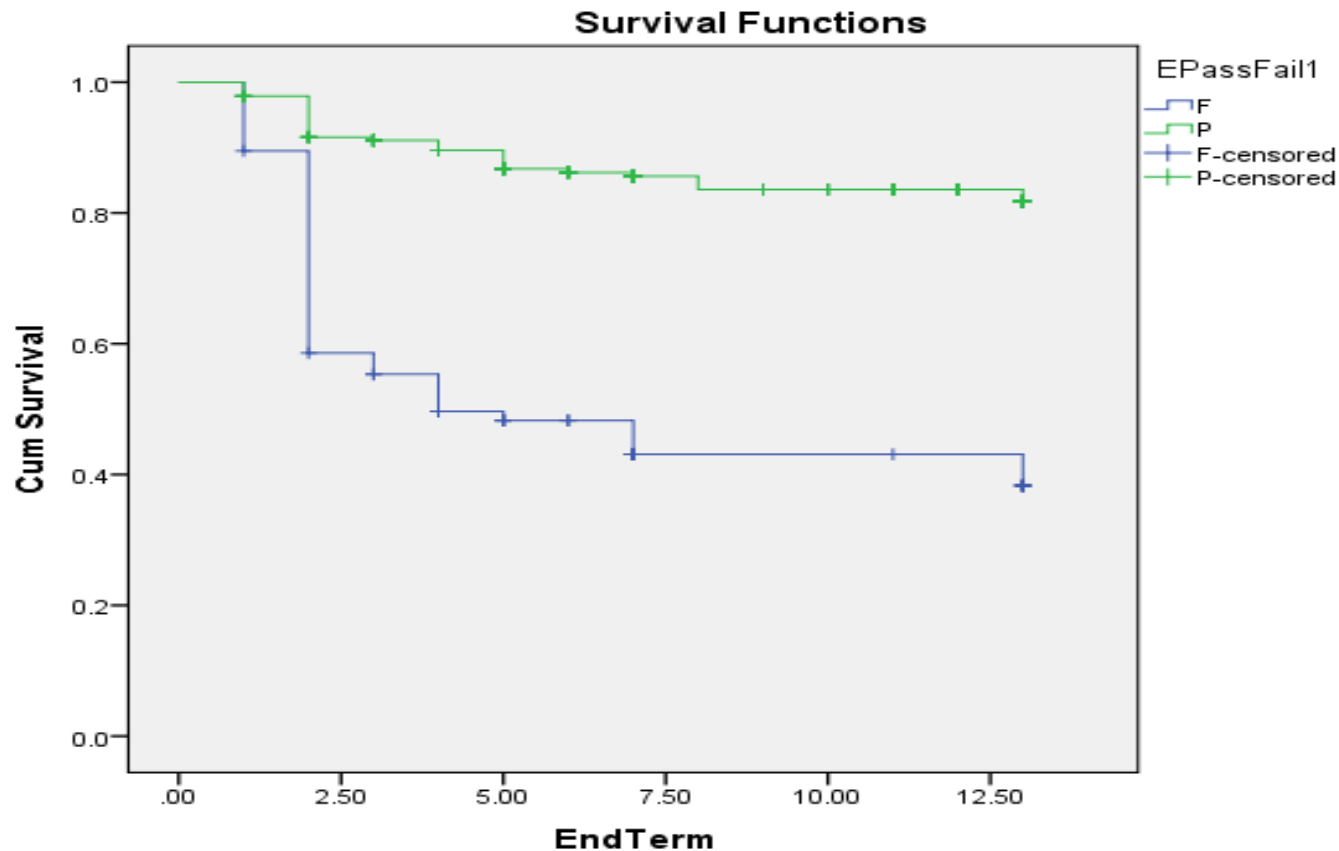
For most students, dropout was related to performance in early mathematics and English courses.

Course	% Retained at Semester 13	
	Failed 1st Attempt	Passed 1st Attempt
Writing & Rhetoric I	32%	80%
College Algebra	52%	90%
Calculus I	80%	93%
Chemistry I	63%	88%

Low-Failure Rate Courses Not Predictive of Dropout or Retention (Physics I with Calculus).

Engineering FTIC ENC 1101

- By semester 13 only 32% of those who failed ENC 1101 were still retained compared to 80% of those who passed.

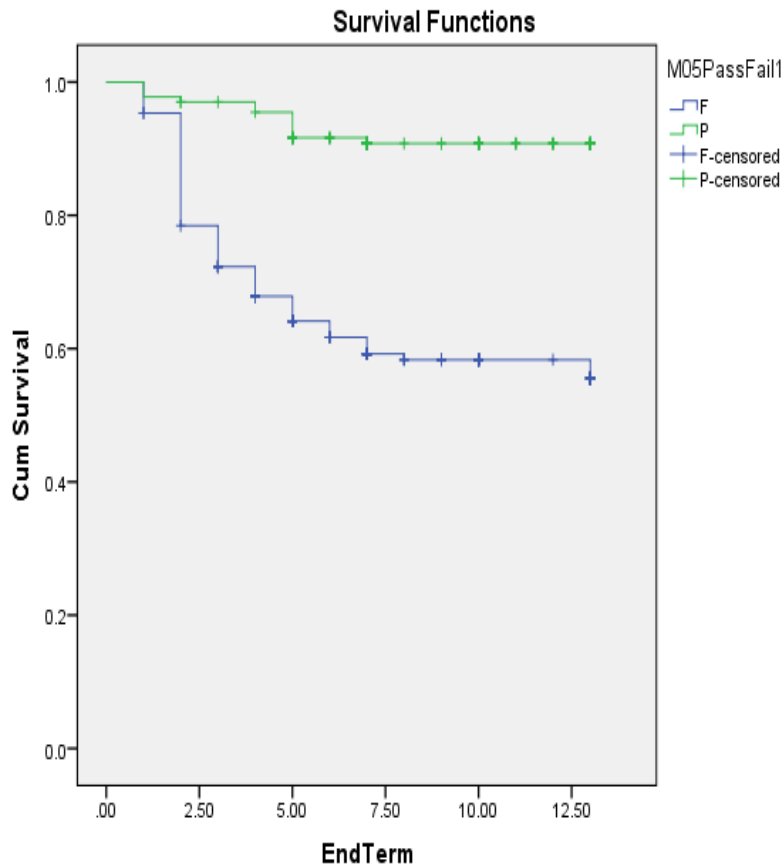


Engineering FTIC ENC 1101 Life Table

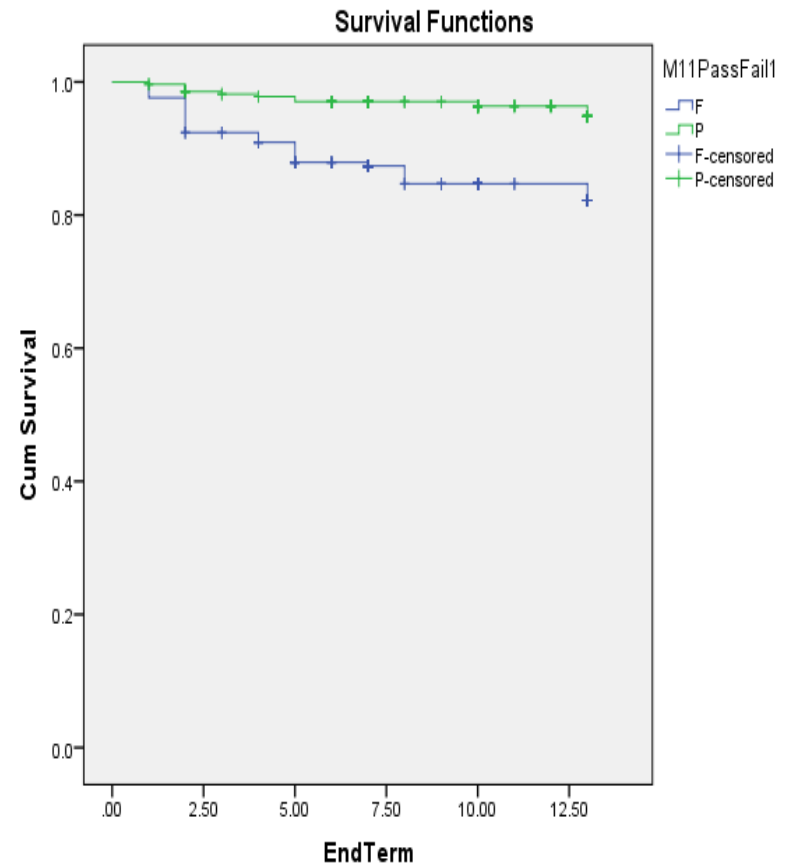
Interval Start Time (Terms)	Number Entering Term	Number Exposed to Risk	Number of Terminal Events	Proportion Terminating	Proportion Surviving	Cumulative Proportion Surviving at End of Term	Hazard (Risk) Rate
Students who Fail							
0-1	95	95.00	0	.00	1.00	1.00	.00
1-2	95	94.50	10	.11	.89	.89	.11
2-3	84	83.50	29	.35	.65	.58	.42
3-4	54	53.00	3	.06	.94	.55	.06
4-5	49	44.50	5	.11	.89	.49	.12
5-6	35	33.00	1	.03	.97	.47	.03
6-7	30	29.00	0	.00	1.00	.47	.00
7-8	28	20.50	3	.15	.85	.40	.16
8-9	10	10.00	0	.00	1.00	.40	.00
9-10	10	10.00	0	.00	1.00	.40	.00
Students who Pass							
0-1	420	420.00	0	.00	1.00	1.00	.00
1-2	420	417.50	9	.02	.98	.98	.02
2-3	406	403.00	26	.06	.94	.92	.07
3-4	374	369.00	2	.01	.99	.91	.01
4-5	362	357.00	6	.02	.98	.90	.85
5-6	346	335.00	11	.03	.97	.87	.83
6-7	313	308.00	2	.01	.99	.86	.02
7-8	301	214.00	2	.01	.99	.85	.01
8-9	125	125.00	3	.02	.98	.83	.02

Engineering FTIC Math

52% percent of students who failed **MAC 1105** were retained at semester 13 compared to 90% of those who passed.

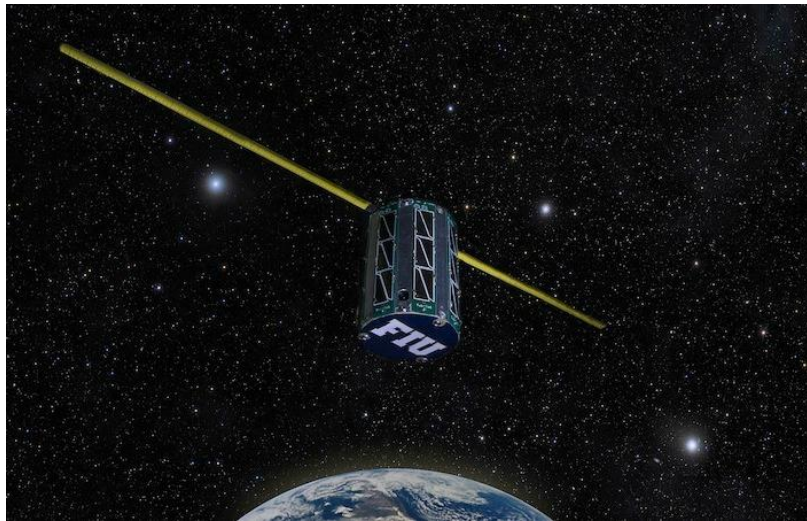


80% of those who failed **MAC 2311** were still retained as were 93% of those who passed.



Changes in Requirements

- Students must place into Calculus I
- If NOT, placed into an exploratory major until Calculus I is passed.





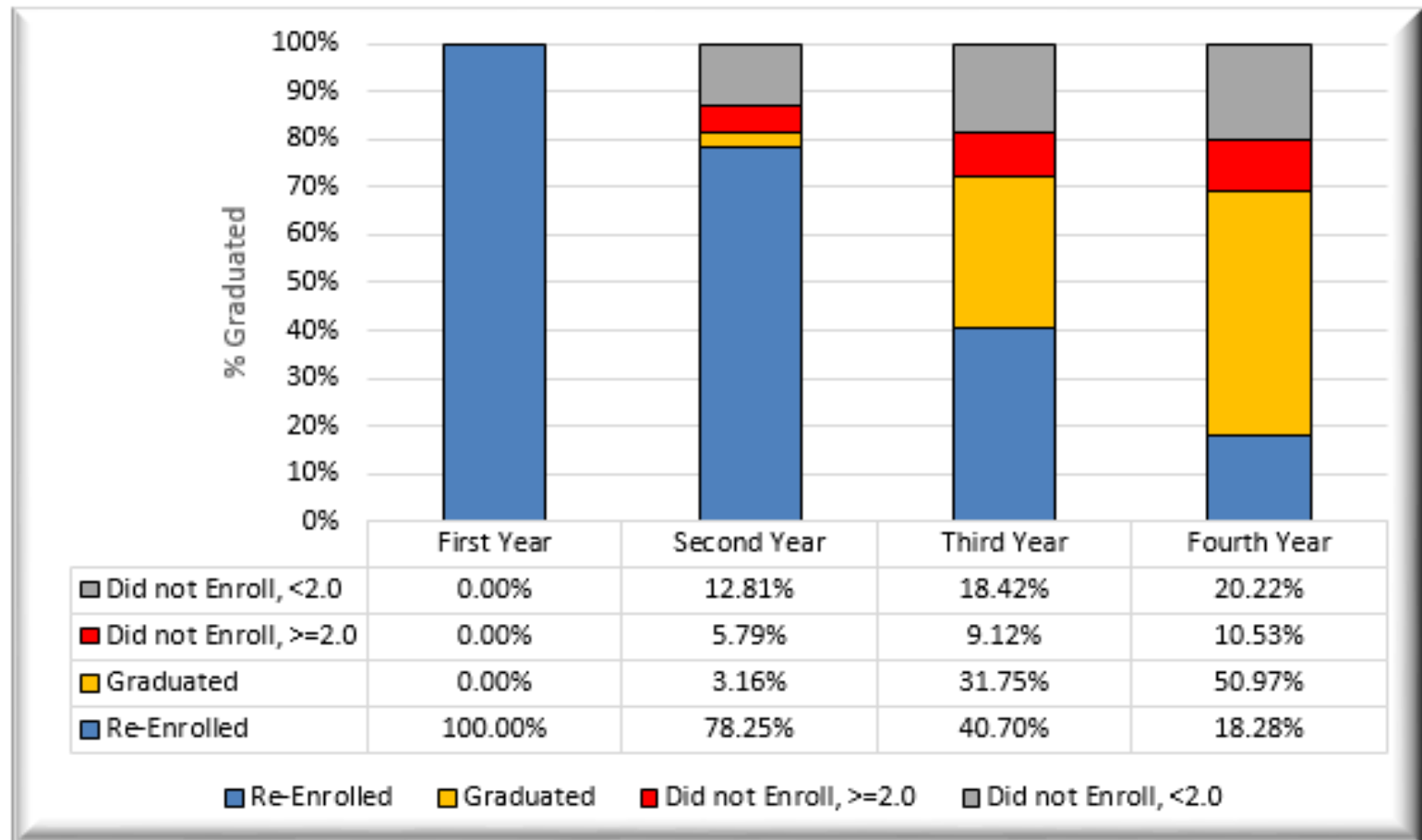
TRANSFER STUDENTS

Transfer with AA Degree



Engineering Transfer Students

- 533 students



Transfer Students

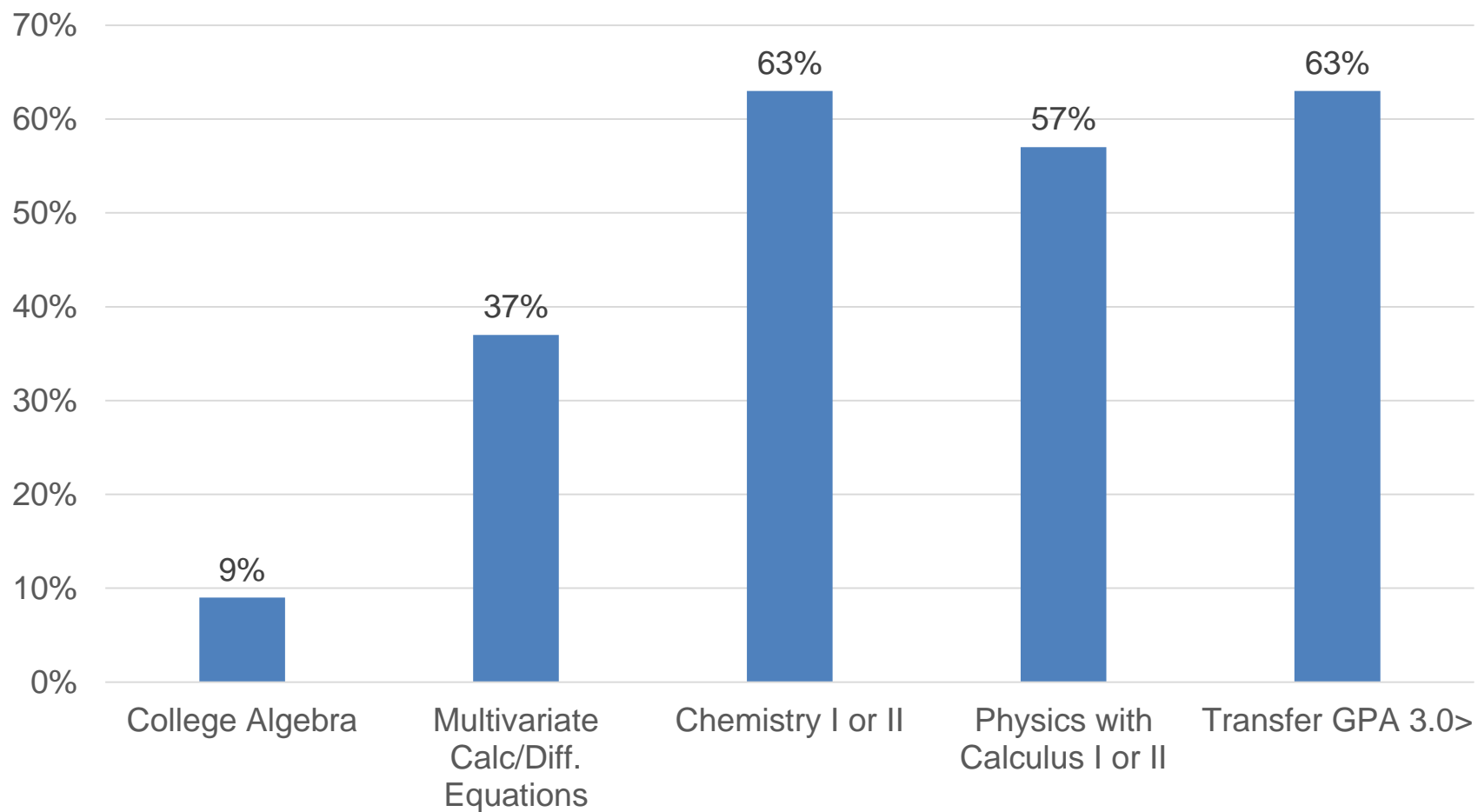
- Students who started at FIU in 2009, 2010 and 2011 with an Associate of Art (AA) degree (n=533)
- Examined the relationship between their
 - Transfer GPA
 - Highest level transfer Math
 - Highest Level transfer Chemistry
 - Highest Level transfer Physics



What is the likelihood of their graduating from FIU within four years?

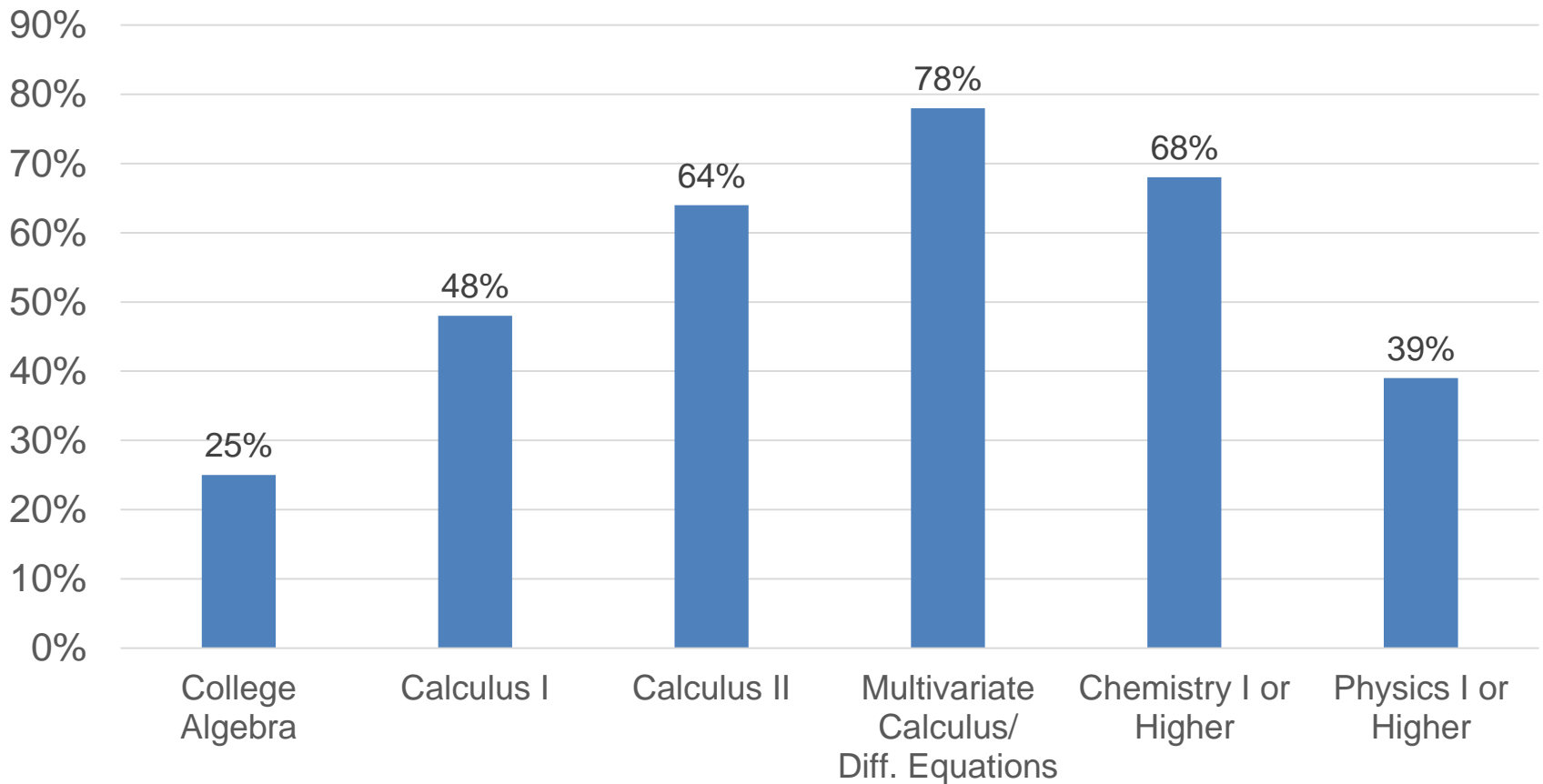
General Findings

AA Transfer Information % Transferred



General Findings

Impact of Highest-Level Courses Transferred on Graduation Rates % Graduated



Cluster Analysis

Cluster analysis: Cluster analysis was conducted to identify the natural groupings of students' transfer GPA and course levels (math, chemistry and physics

1. We used the k-means clustering method with $k=2$ to push observations into one of two groups or clusters (graduated/not graduated).

Cluster Findings

Final Cluster Centers		
	Cluster 1 (n=310)	Cluster 2 (n=194)
Math Level	5- Differential Equations	2- Calculus I
Chemistry Level	3- General Chemistry I	1- Fundamental Chemistry
Physics Level	3- Physics with Calculus	0- Physics without Calculus I
Transfer GPA	5-3.00-3.24	5- 3.00-3.24

* 29 students did not fit into either

Next: Discriminant Function Analysis

Discriminant

Discriminant Function Analysis: Discriminant function analysis is used to determine which variables discriminate between two or more naturally occurring groups.

Predict group membership based on a linear combination of the interval variables.

The procedure begins with a set of observations where **both** group membership (graduated/not graduated) **and** the values of the interval variables are known.

1. “Leave one out classification” option –

Note: This method is often applied in analyses of small data sets where there are insufficient cases to do a 50% holdout sample (Burns, R. & Burns, R. 2008).

Discriminant Findings

Fisher Coefficients for Graduation or Non-Graduation		
	Graduate (n=321)	Non-Graduate (n=212)
Math Level	2.46	1.42
Transfer GPA	1.78	1.82
(Constant)	-7.22	-4.76

The analysis generated one significant function which distinguished a significant difference between the two groups.

$$\Lambda = .838, \chi^2(2, N=533) = 93.636, p < .000$$

Discriminant Findings

- Two variables, **level of math** course transferred in and **transfer GPA**, were significant in distinguishing between the two groups (i.e., graduated and non-graduated).
- The analysis was better at predicting who would graduate (82% accuracy) than at predicting who would not (51% accuracy). These results mirrored the cluster analysis results and had an overall accuracy level of 70%.

Program Changes

- IT, Construction Management Programs were fine....
- Increase admission requirements for AA transfer students seeking to join the Engineering Majors:
- Increase the transfer GPA requirement to 3.0, as these students have a 61%+ graduation rate, while those with lower GPAs have a graduation rate below 50%;
- **and** require completion of at least Calculus I (64% graduation rate).

Summary

- Know your student patterns... they determine your research question and why you are researching it in the first place
- Don't be afraid to try other unexplored methods...it takes time
- Data gathering and coding are critical...
- Don't be afraid to not “know” an answer on your output right away... these come through discussions...
- Look to other researchers for help...



What are Your Questions???



References/Resources

FTIC – Survival Analysis

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SAGE Publishing Inc., Chapter 25 pp. 589-608

Engineering FTIC ENC 1101

Interval Start Time (Terms)	Number Entering Term	Number Withdrawing during Term	Number Exposed to Risk	Number of Terminal Events	Proportion Terminating	Proportion Surviving	Cumulative Proportion Surviving at End of Term	Hazard (Risk) Rate
Students who Fail								
0-1	95	0	95.00	0	.00	1.00	1.00	.00
1-2	95	1	94.50	10	.11	.89	.89	.11
2-3	84	1	83.50	29	.35	.65	.58	.42
3-4	54	2	53.00	3	.06	.94	.55	.06
4-5	49	9	44.50	5	.11	.89	.49	.12
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6-7	30	2	29.00	0	.00	1.00	.47	.00
7-8	28	15	20.50	3	.15	.85	.40	.16
8-9	10	0	10.00	0	.00	1.00	.40	.00
9-10	10	0	10.00	0	.00	1.00	.40	.00
10-11	10	0	10.00	0	.00	1.00	.40	.00
11-12	10	1	9.50	0	.00	1.00	.40	.00
12-13	9	0	9.00	0	.00	1.00	.40	.00
13	9	8	5.00	1	.20	.80	.32	.00
Students who Pass								
0-1	420	0	420.00	0	.00	1.00	1.00	.00
1-2	420	5	417.50	9	.02	.98	.98	.02
2-3	406	6	403.00	26	.06	.94	.92	.07
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7-8	301	174	214.00	2	.01	.99	.85	.01
8-9	125	0	125.00	3	.02	.98	.83	.02
9-10	122	6	119.00	0	.00	1.00	.83	.00
10-11	116	5	113.50	0	.00	1.00	.83	.00
11-12	111	10	106.00	0	.00	1.00	.83	.00
12-13	101	9	96.50	0	.00	1.00	.83	.00
13	92	90	47.00	2	.04	.96	.80	.00

Engineering FTIC MAC 1105

**Appendix 2
MAC 1105 Life Table**

Interval Start Time (Terms)	Number Entering Term	Number Withdrawing during Term	Number Exposed to Risk	Number of Terminal Events	Proportion Terminating	Proportion Surviving	Cumulative Proportion Surviving at End of Term	Haz: (Risk Rate)
Students who Fail								
0	215	0	215	0	0	1	1	0
1	215	2	214	10	0.05	0.95	0.95	0.05
2	203	1	202.5	36	0.18	0.82	0.78	0.2
3	166	7	162.5	13	0.08	0.92	0.72	0.08
4	146	9	141.5	9	0.06	0.94	0.68	0.07
5	128	15	120.5	7	0.06	0.94	0.64	0.06
6	106	4	104	4	0.04	0.96	0.61	0.04
7	98	26	85	4	0.05	0.95	0.58	0.05
8	68	3	66.5	1	0.02	0.98	0.57	0.02
9	64	5	61.5	0	0	1	0.57	0
10	59	37	40.5	0	0	1	0.57	0
11	22	0	22	0	0	1	0.57	0
12	22	1	21.5	0	0	1	0.57	0
13	21	20	11	1	0.09	0.91	0.52	0
Students who Pass								
0	134	0	134	0	0	1	1	0
1	134	0	134	3	0.02	0.98	0.98	0.02
2	131	2	130	1	0.01	0.99	0.97	0.01
3	128	1	127.5	0	0	1	0.97	0
4	127	1	126.5	2	0.02	0.98	0.95	0.02
5	124	9	119.5	5	0.04	0.96	0.91	0.04
6	110	4	108	0	0	1	0.91	0
7	106	45	83.5	1	0.01	0.99	0.9	0.01
8	60	1	59.5	0	0	1	0.9	0
9	59	2	58	0	0	1	0.9	0
10	57	29	42.5	0	0	1	0.9	0
11	28	3	26.5	0	0	1	0.9	0
12	25	4	23	0	0	1	0.9	0
13	21	21	10.5	0	0	1	0.9	0