

Iteration and Innovation in Higher Education: A New Mexico Tale



Greg Heileman

*Associate Provost
University of Kentucky*

*Institute for Design & Innovation
University of New Mexico*

A photograph of a stage setup. Two red velvet curtains are drawn back, held by gold-colored curtain rods. The stage floor is made of polished wood planks. In the center, the words "Higher Education" are displayed in a large, bold, white sans-serif font.

Higher Education

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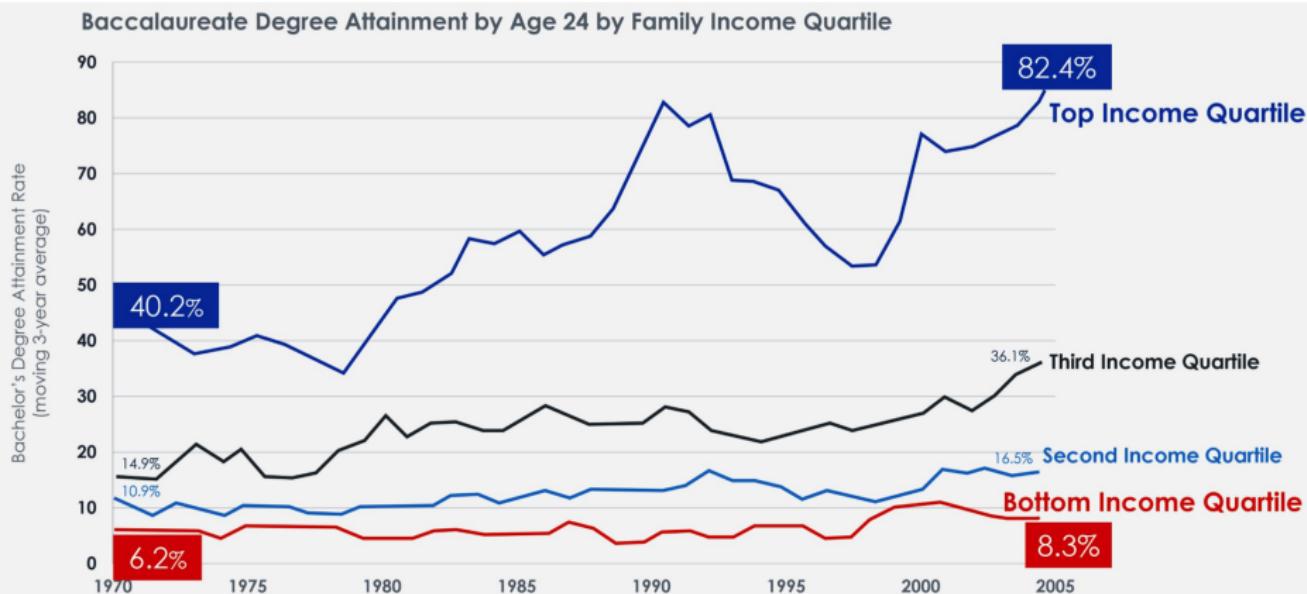
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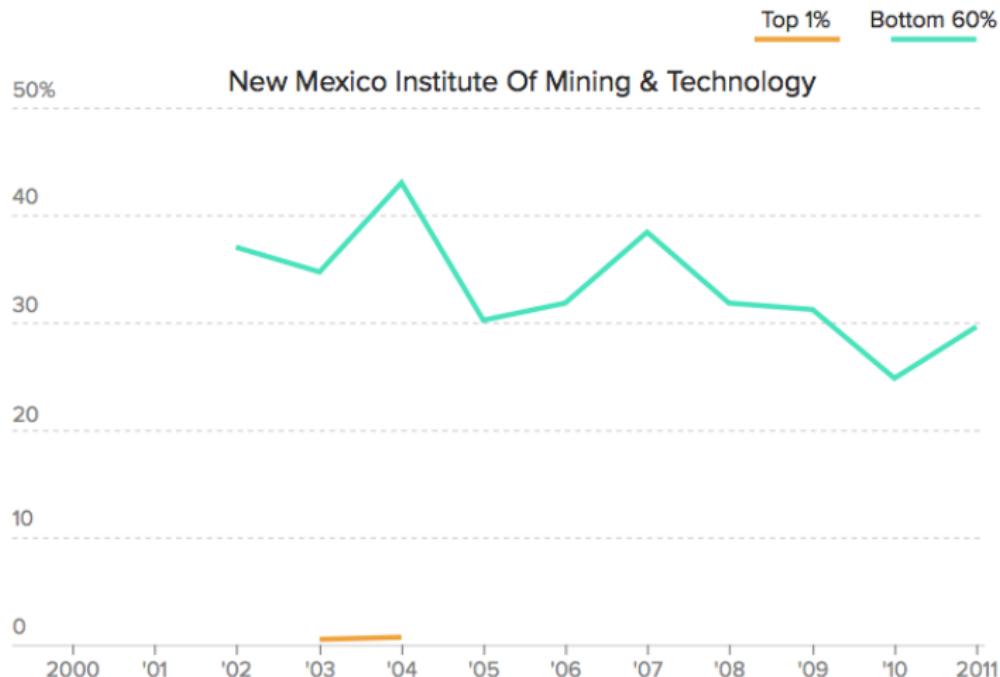
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 - Lost opportunity – \$45,327 in salary.
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- State support increasingly tied to outcomes, rather than enrollment.

Attainment Gap



Source: New York Times, "The Reproduction of Privilege," March 12, 2012

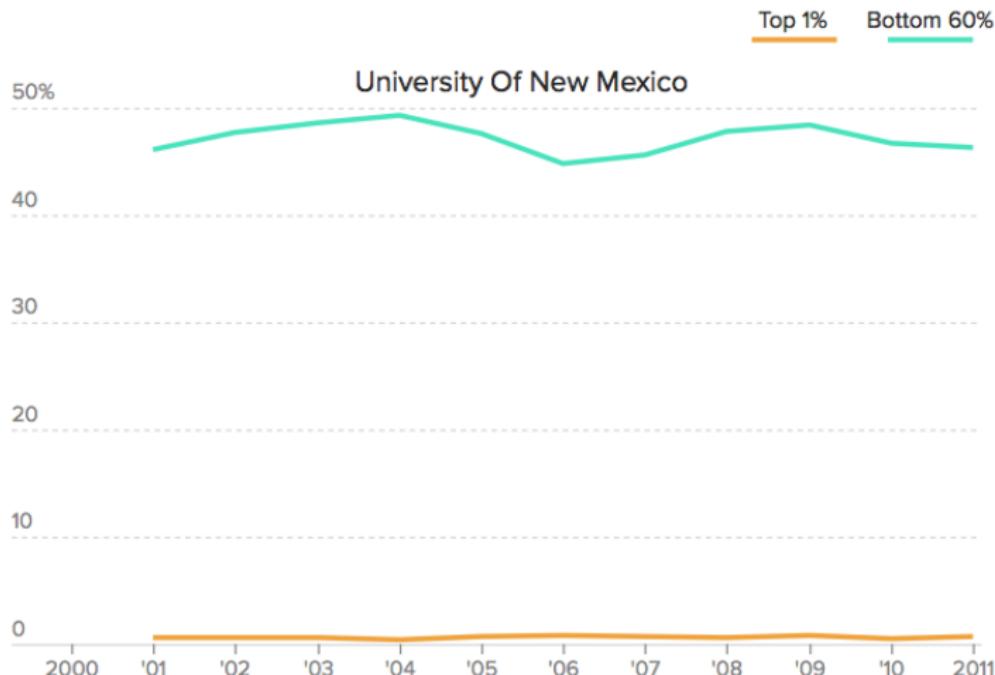
Who We Serve



SOURCE: Equality of Opportunity Project

NOTE: Data is from tax filings and tuition records, spanning from 2000 to 2011.

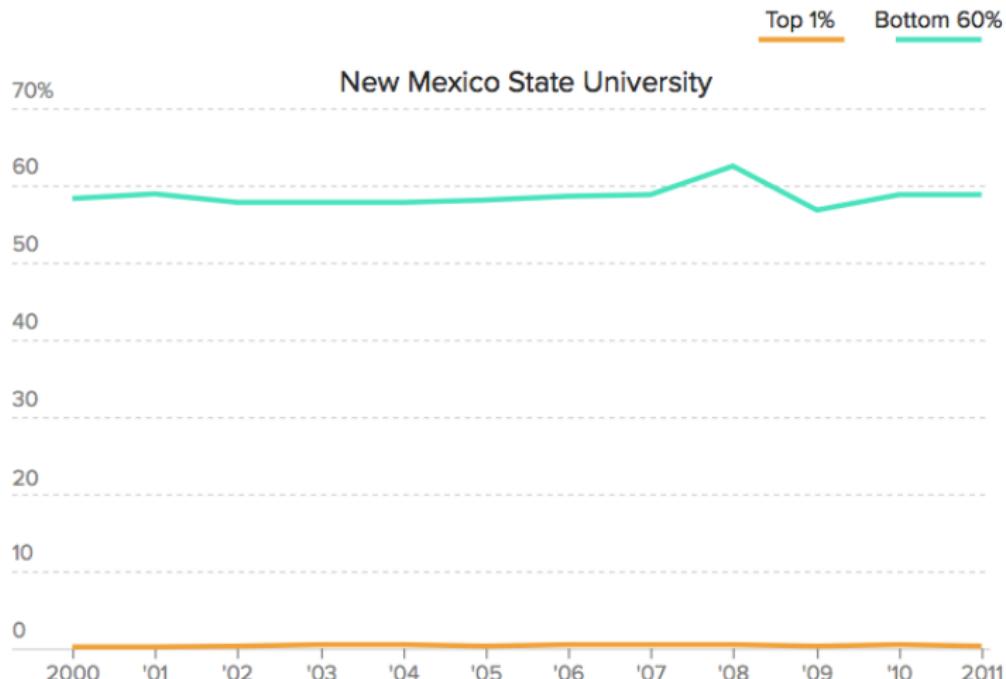
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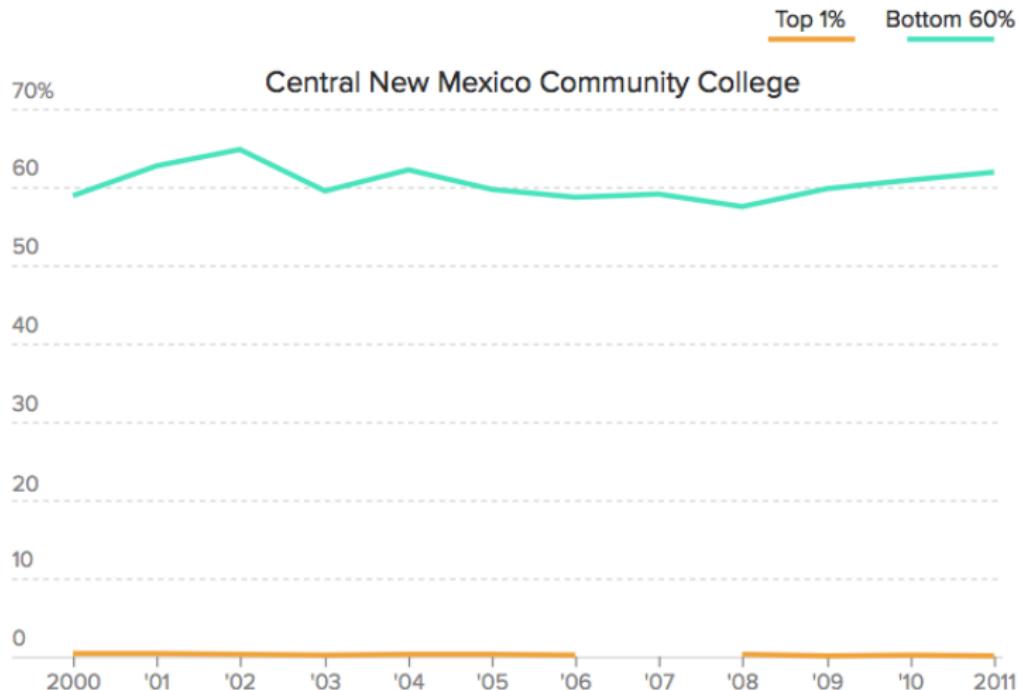
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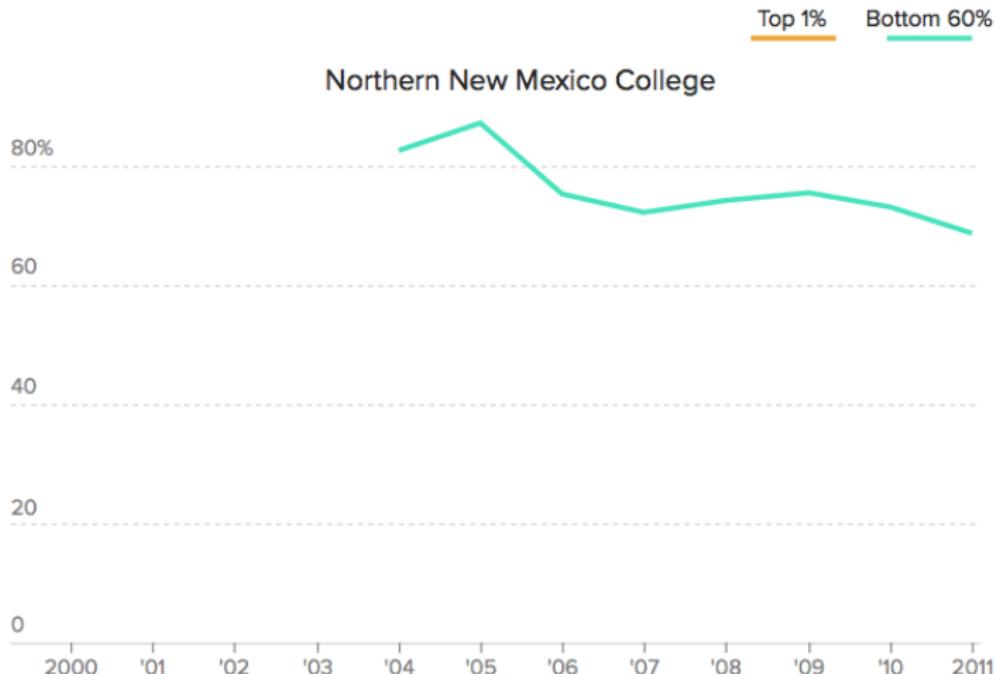
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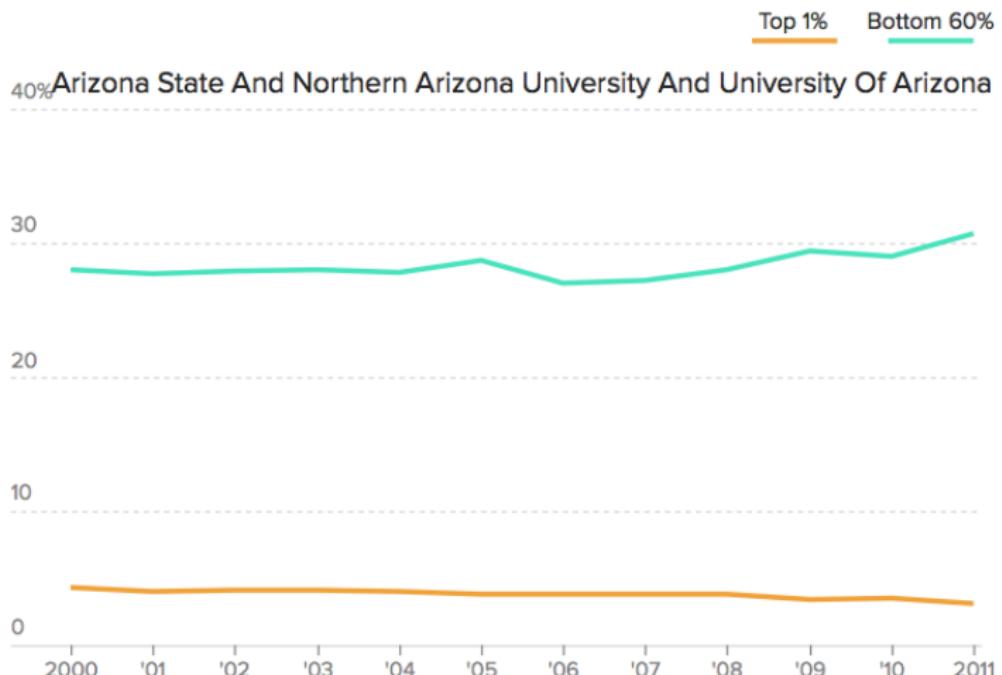
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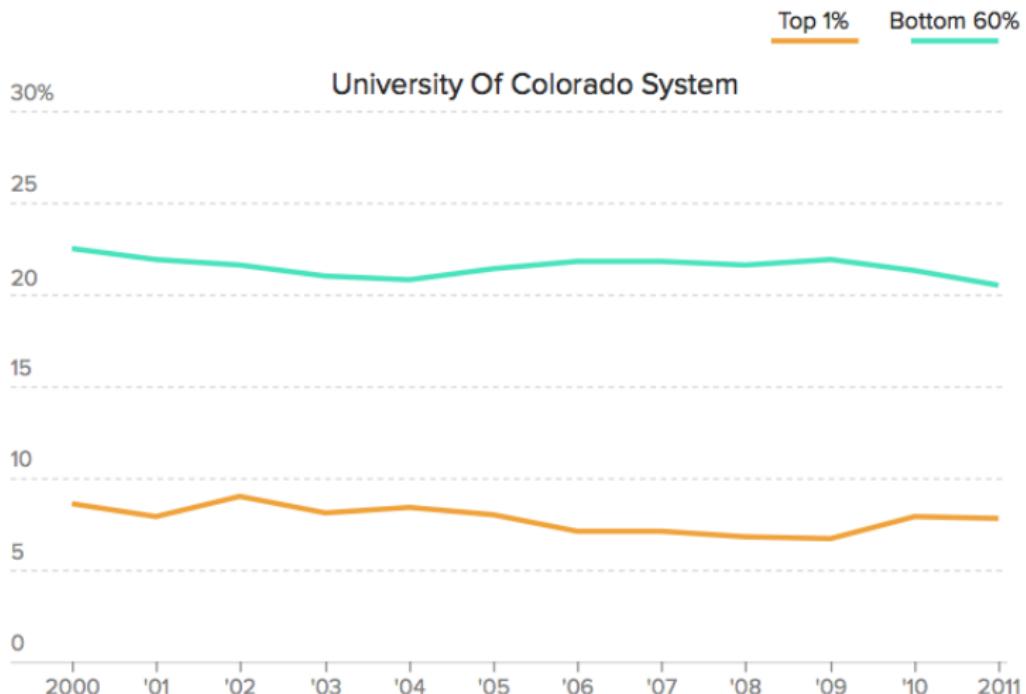
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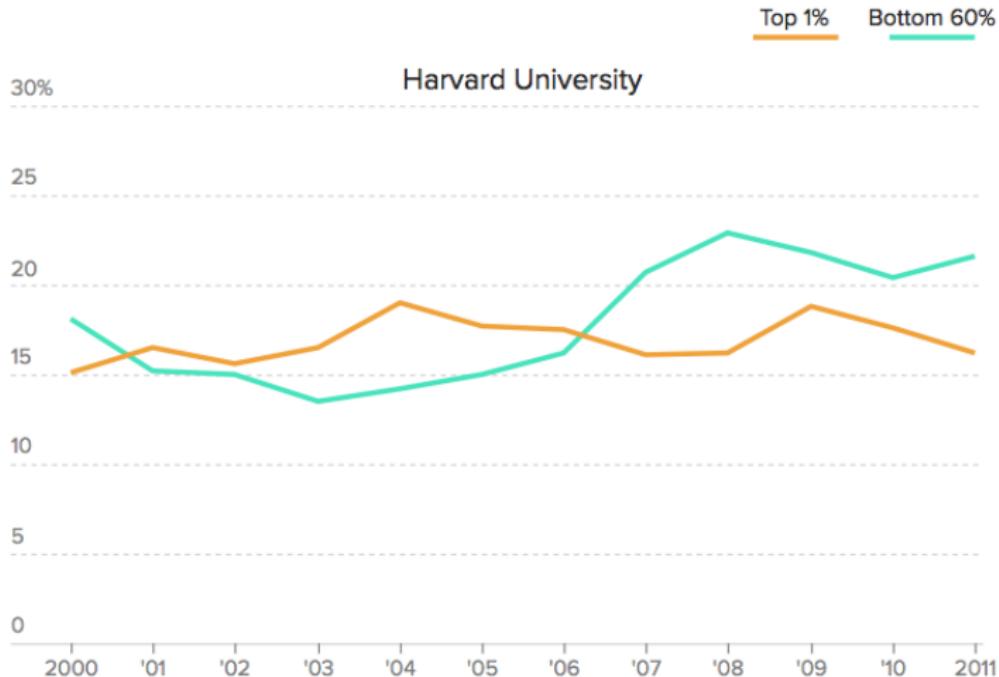
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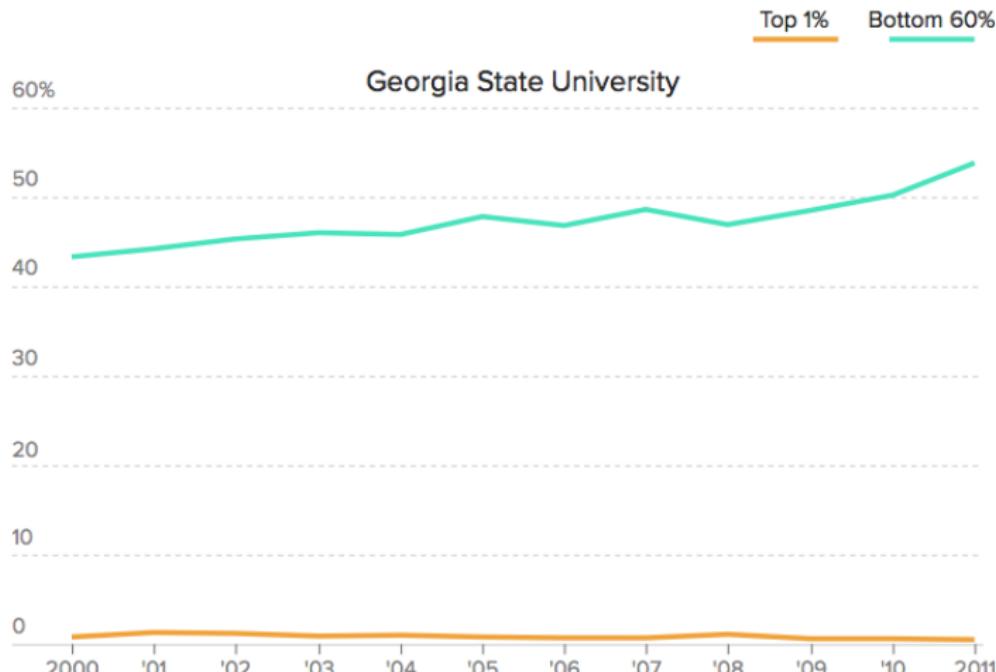
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- **Saves students \$35M/year.**





*Student
Affairs*



***Student
Affairs***

***Academic
Affairs***

*student outreach
service learning
support services*



*Student
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*Academic
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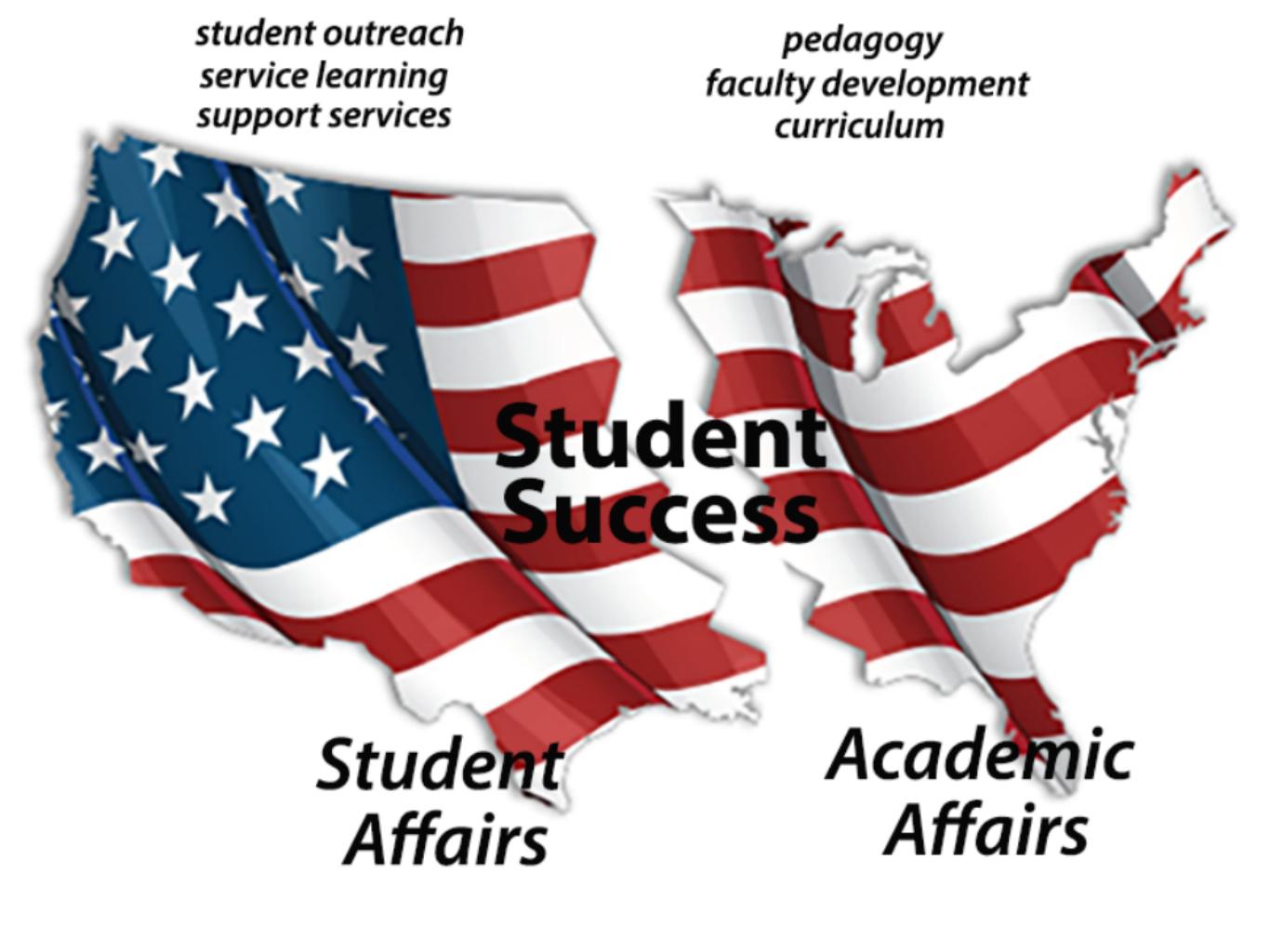
*student outreach
service learning
support services*

*pedagogy
faculty development
curriculum*



***Student
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A graphic of the United States map filled with the stars and stripes of the American flag. The map is slightly crumpled and has torn edges, particularly along the coastlines.

*student outreach
service learning
support services*

*pedagogy
faculty development
curriculum*

Student Success

*Student
Affairs*

*Academic
Affairs*

A New Mexico Tale

A wide-angle photograph of the Sandia Mountains in New Mexico. The mountains are dark silhouettes against a vibrant sky filled with wispy clouds colored in shades of orange, yellow, and blue. In the foreground, there's a field of tall, dry grass swaying in the wind.

Know Thyself



STRATEGY =
TAKE THE RIVER



TACTICS =
USE A BOAT

Student Success – Two Key Points

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–French Proverb, circa 1190

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- ② **Student success depends on local conditions**
– what works at one place may not work at another.

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 - Dedicated Support from University Leadership

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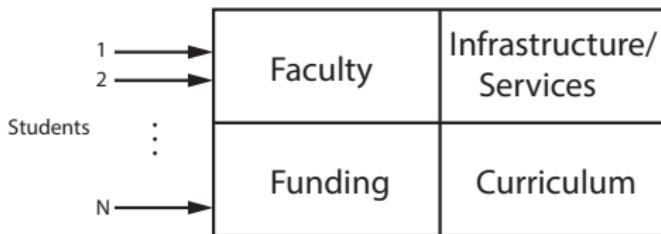
The university “systems” are different.

Student Success – Context

Faculty	Infrastructure/ Services
Funding	Curriculum

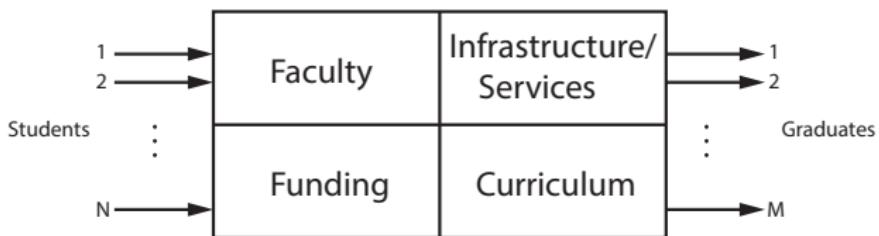
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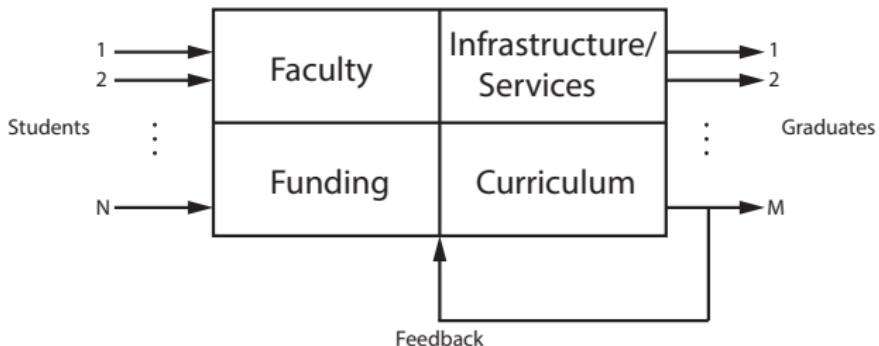
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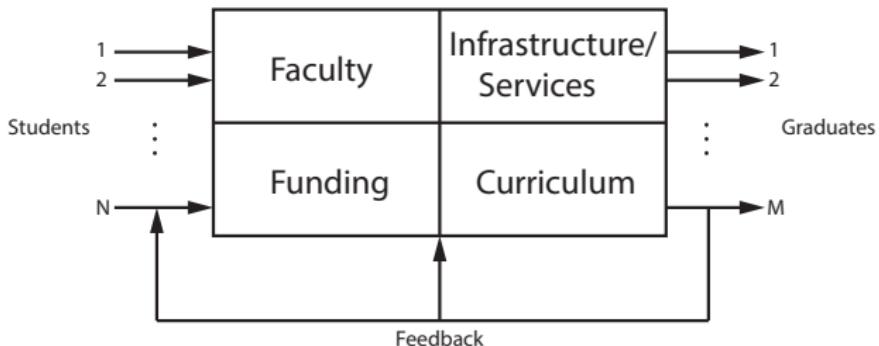
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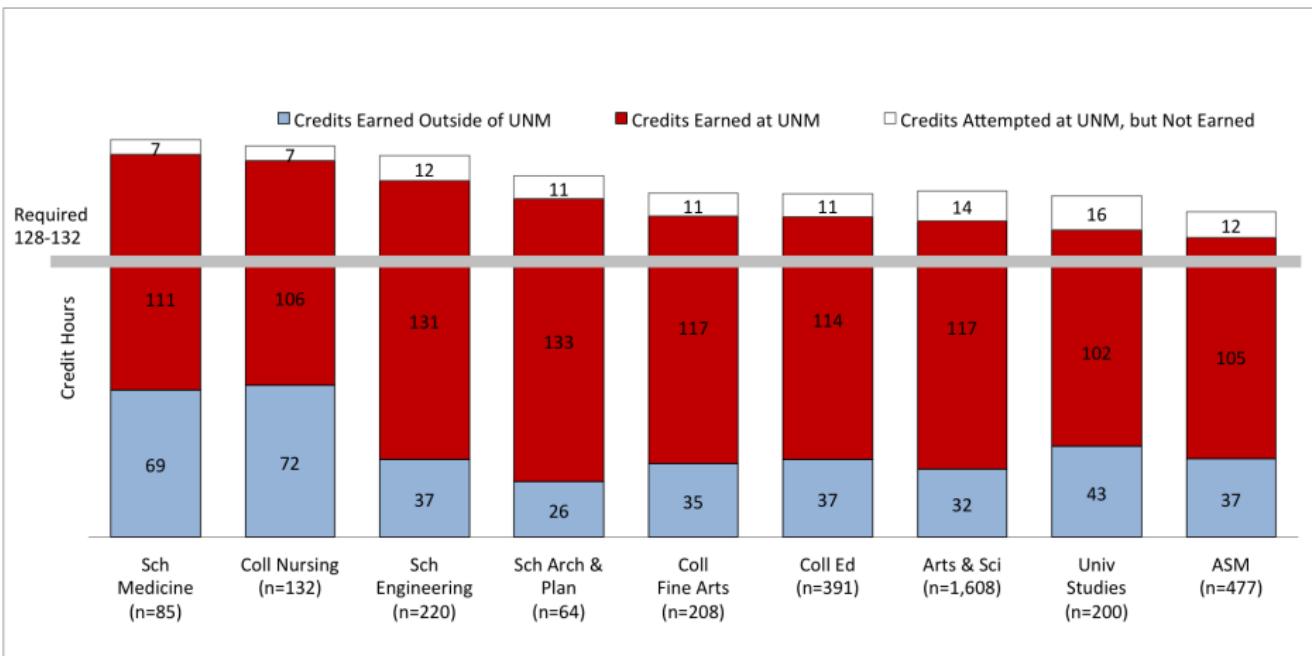
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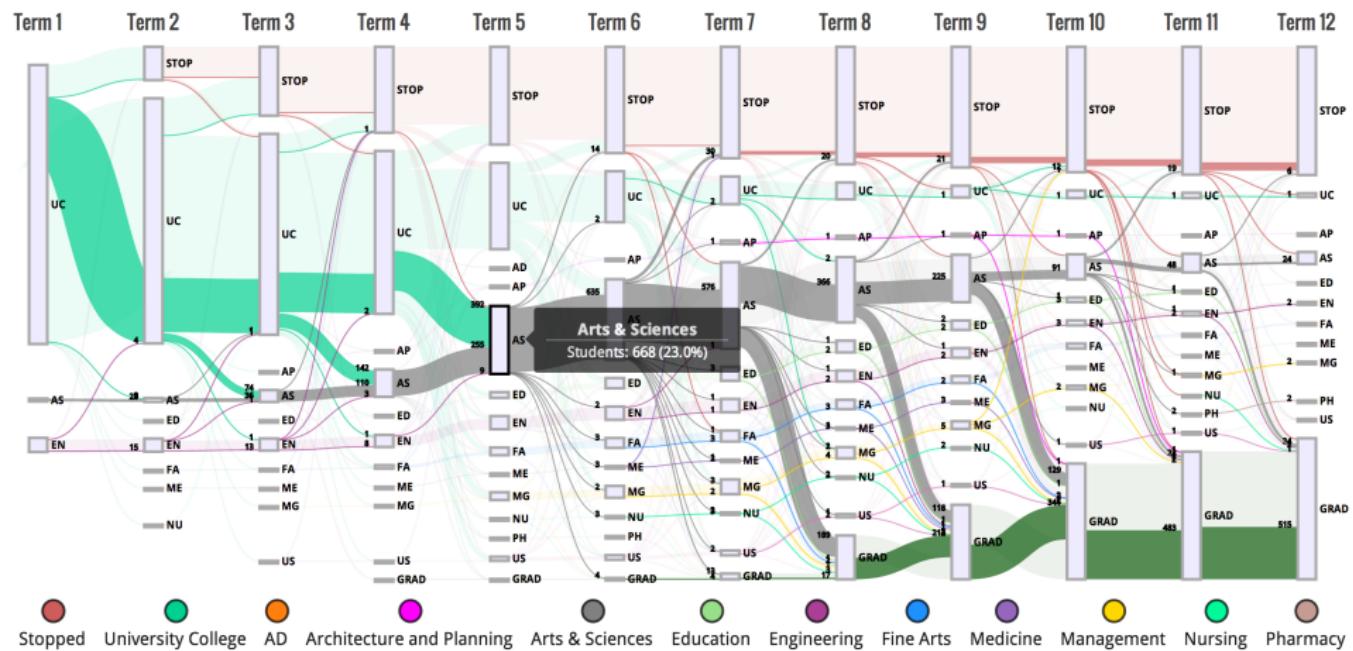
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 - **Mass**: must accumulate the credit hours required to graduate.
 - **Velocity** (a vector): these must be on the right trajectory, i.e., useful credits.

Student Analytics – Mass

Avg. credit hours, UNM bachelor's recipients, 2011-12 AY:



Student Analytics – Velocity



Sticking with the Physics Metaphors

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Efficiency Measure = Credits that Count/Total Credits

A photograph of a modern architectural complex made of light-colored concrete blocks. The building features large, multi-story glass windows that are brightly lit from within, creating a warm glow against the dark blue night sky. A tall, thin street lamp stands in the foreground on the left, its light reflecting off the building's facade. In the bottom foreground, the blurred lights of moving vehicles create streaks of red and orange across the dark asphalt of a road.

Our Journey

Analytics and Student Success

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- Affordability – built using cloud components and services

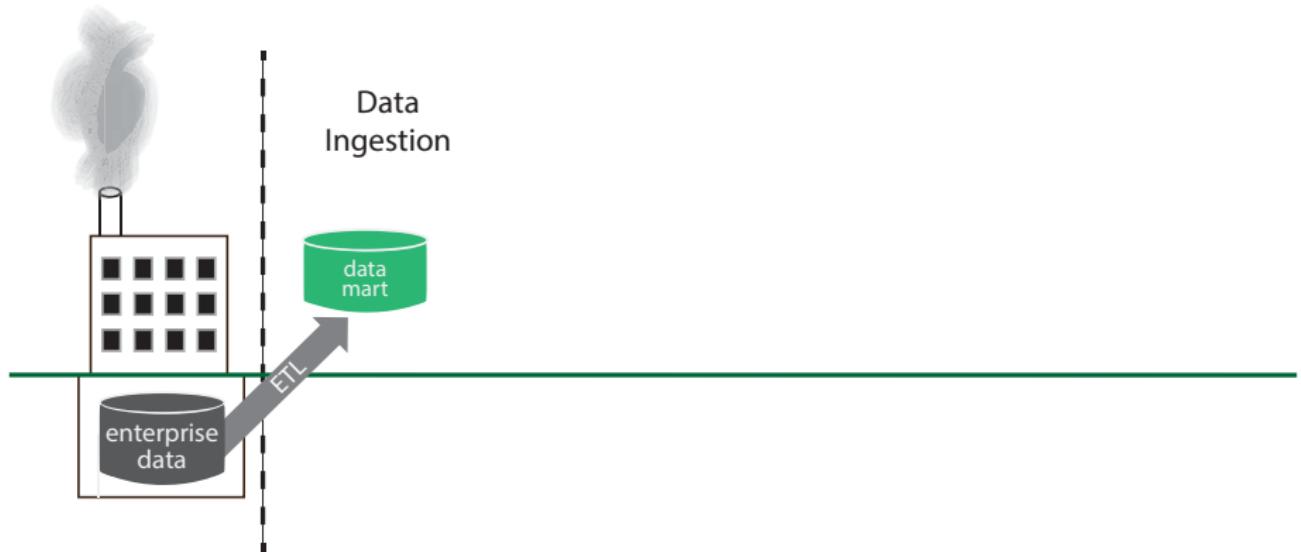


PROTESTING AGAINST NEW TECHNOLOGY - THE EARLY DAYS

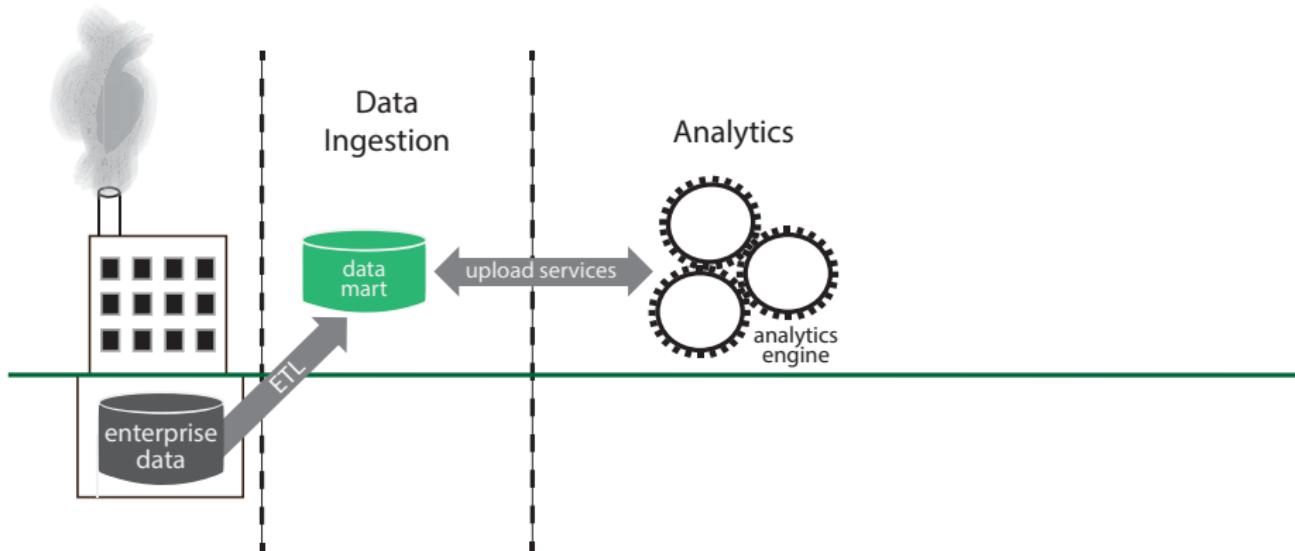
Analytics Workflow



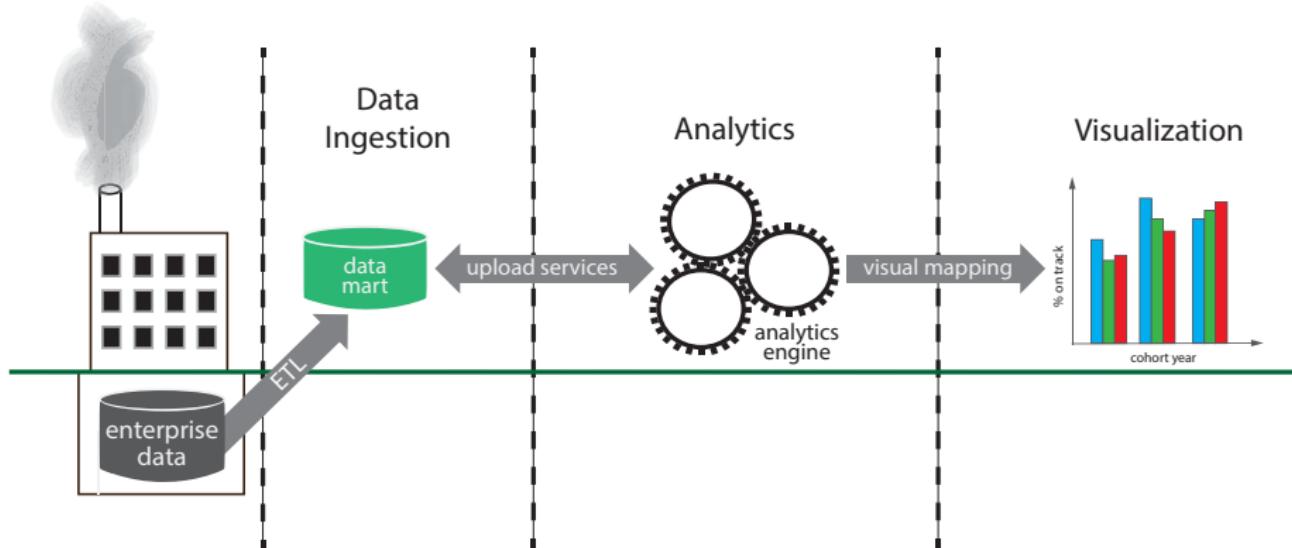
Analytics Workflow



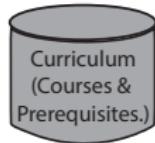
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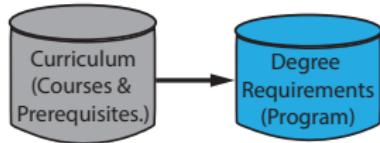


Analytics Journey

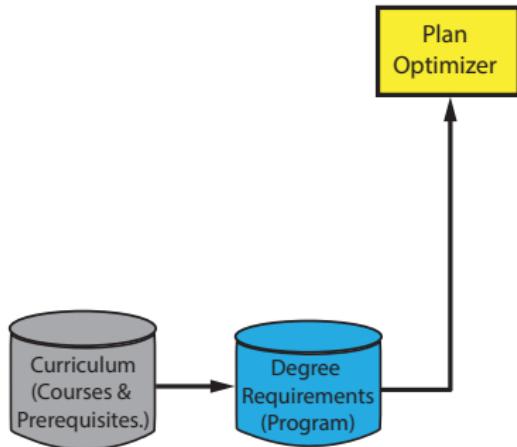


Curriculum
(Courses &
Prerequisites.)

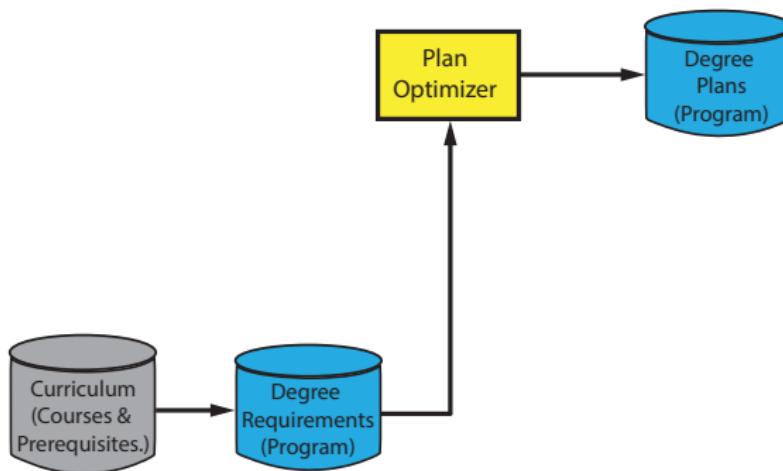
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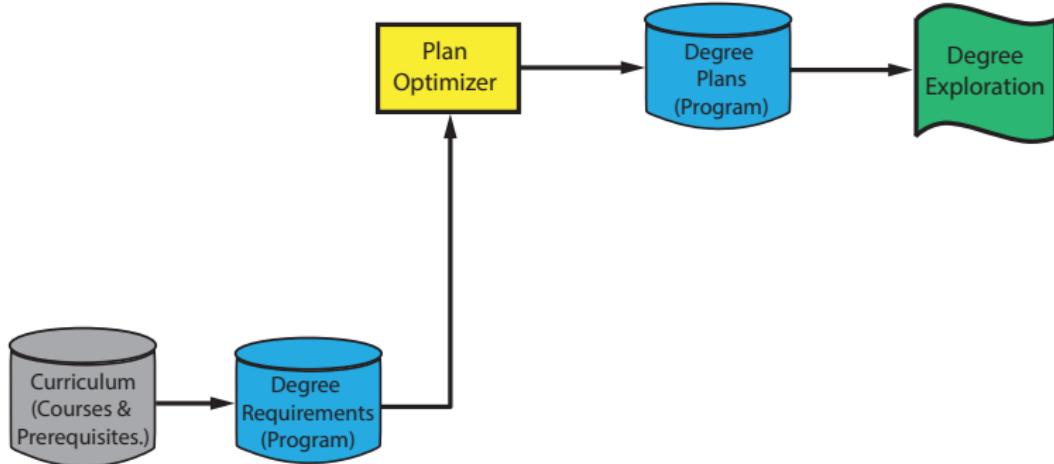
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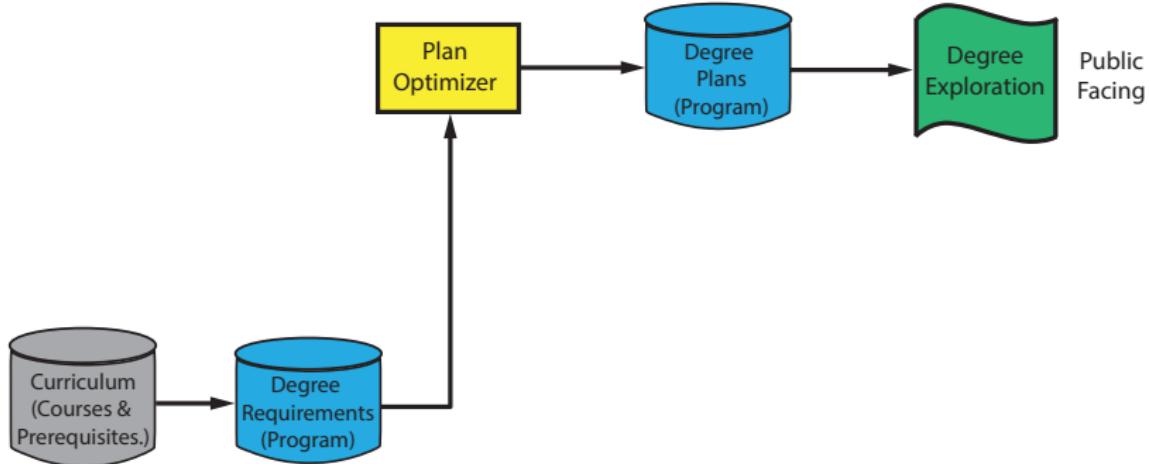
Analytics Journey



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THE UNIVERSITY of
NEW MEXICO

UNM's Academic Programs: Undergraduate Degrees:

Undergraduate Degrees

Arts & Culture

Have you been interested in how humans and societies interact with each other from a perspective of race, ethnicity, gender and nationality? Does the intersection of arts, culture and the world stimulate you to think critically? UNM prides itself on its diversity and by majoring in an arts and culture area, you will emerge with a dynamic mindset of inquiry to delve deeper into these topic areas.

[Learn More ▶](#)



Explore By Interest:

Arts & Culture

Teaching & Learning
Life Sciences, Health & Healthcare
Social Science & Transformation

Business, Finance & Economics

Energy & Environment
Humanities & Languages
Physical Sciences

Computing & Cyberspace

Engineering & Mathematics
Infrastructure, Construction & Design
Policy & Politics

Creative Expressions

Exploratory & Interdisciplinary
Law & Social Justice
Technology & Science

Explore By College:

University College
College of Fine Arts
Anderson School of Management
School of Engineering
University Libraries
College of Nursing

Honors College
College of Arts & Sciences
College of Education
School of Architecture and Planning
School of Medicine

Explore By Keyword:

Search

Analytics Journey

The screenshot shows a web browser window with the URL nmhu.degrees.nmrpsp.org. The page has a purple header with the university logo and navigation icons. The main content features a dark blue background with a faint image of biological structures. The title "BIOLOGICAL AND BIOMEDICAL SCIENCES." is prominently displayed in white. Below it, a description reads: "Instructional programs that focus on the biological sciences and the non-clinical biomedical sciences, and that prepare individuals for research and professional careers as biologists and biomedical scientists." A "BACK" button is visible. On the right side, there is a "Show Archived" button. The main body of the page lists academic programs under "Arts & Sciences".

Show Archived

Arts & Sciences

PROGRAM BA-Biology	1 Plan(s)	120 Credit Hours
PROGRAM BS Biology	1 Plan(s)	120 Credit Hours
PROGRAM BS Biol-Con in Teaching	1 Plan(s)	120 Credit Hours

Analytics Journey



THE UNIVERSITY of
NEW MEXICO

UNM's Academic Programs » Explore: Undergraduate Degrees » Degree Plan: Computer Engineering

Undergraduate Degrees

2013-14 Degree Plan

Computer Engineering, BS

[Graph View](#)

School of Engineering: Department of Electrical & Computer Engineering

4 Year Plan

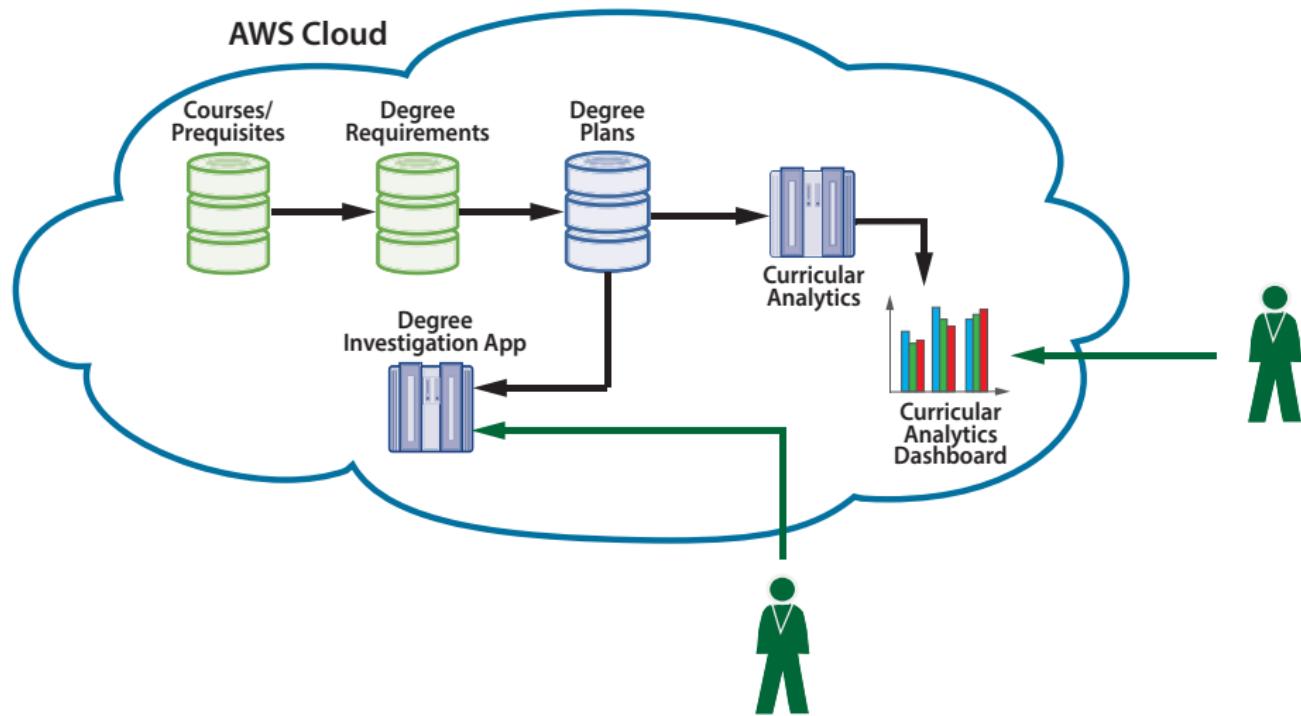
Starting Math:150

CNM to UNM Transfer

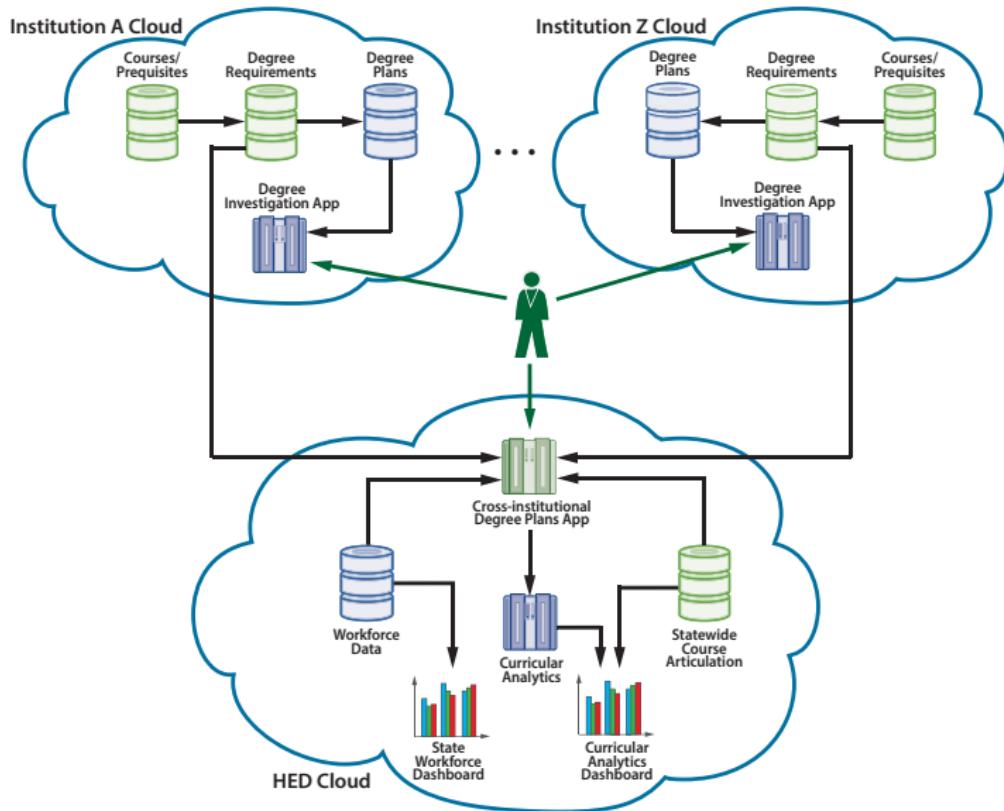
Term 1	Hours Towards Degree: 17	Crucial course: ①	Hours	Minimum Grade	Notes
ENGL 101: Composition I: Exposition			3	C	
① MATH 162: Calculus I			4	C	
ECE 101: Introduction to Electrical & Computer Engineering			1	C	
ECE 131: Introduction to Programming			3	C	
① PHYC 160: General Physics I			3	C	
ECON 105: Macroeconomics or ECON 106: Microeconomics			3	C	
Term Hours:			17		

Term 2	Hours Towards Degree: 34	Crucial course: ①	Hours	Minimum Grade	Notes
ENGL 102: Composition II: Analysis and Argument			3	C	
① MATH 163: Calculus II			4	C	
① PHYC 161: General Physics II			3	C	
PHYC 161L: General Physics II Lab			1	C	
ECE 231: Intermediate Programming			3	C	

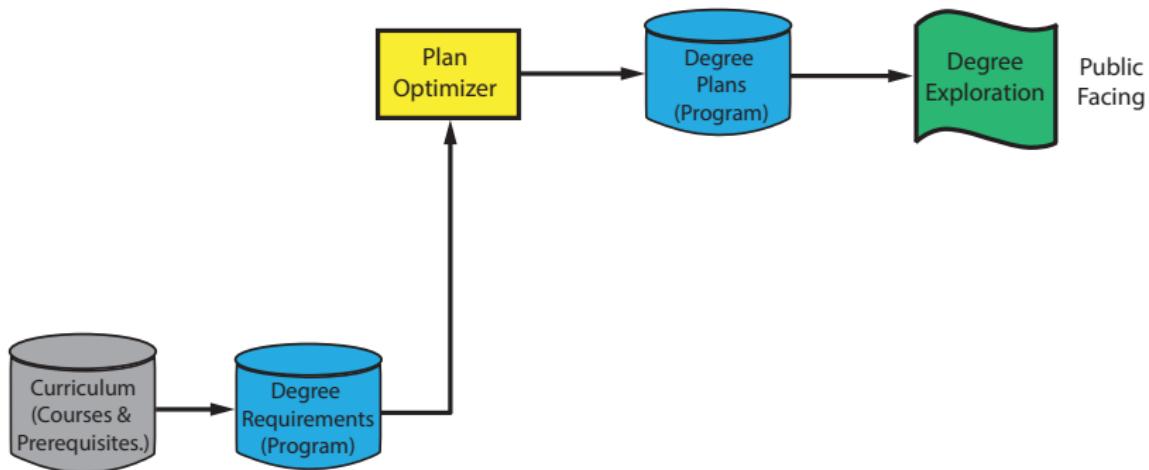
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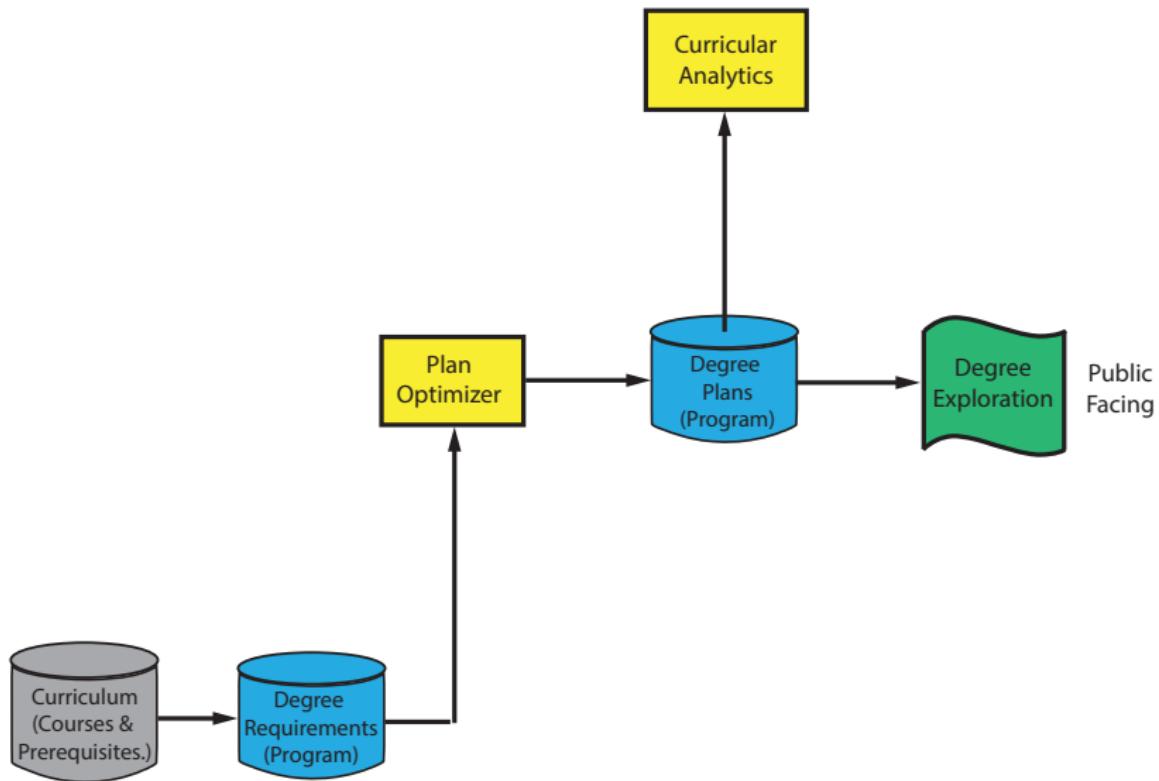
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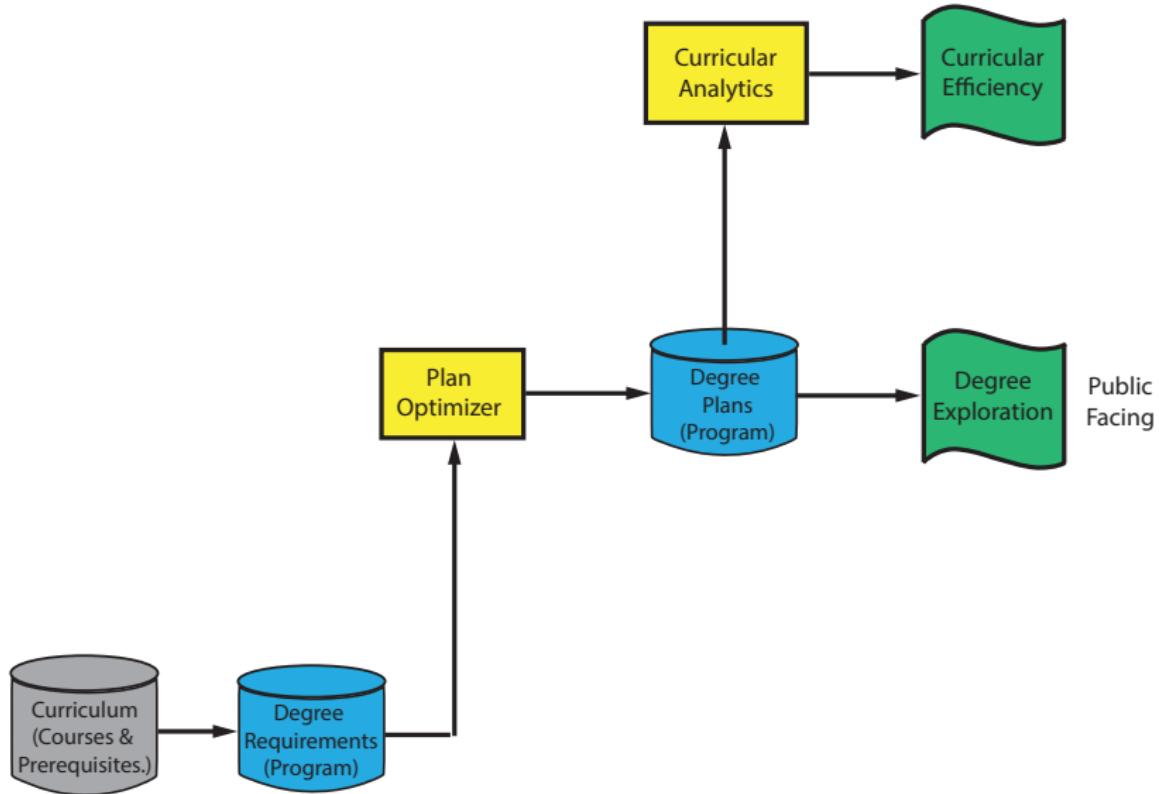
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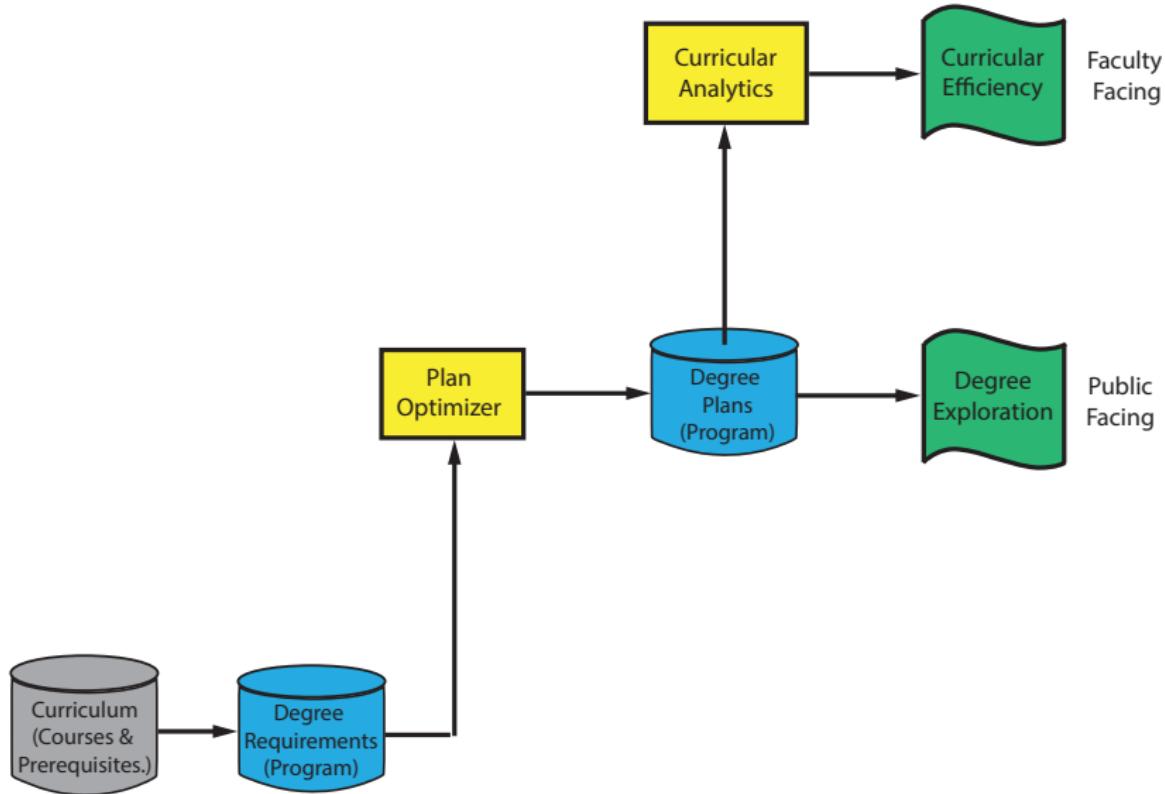
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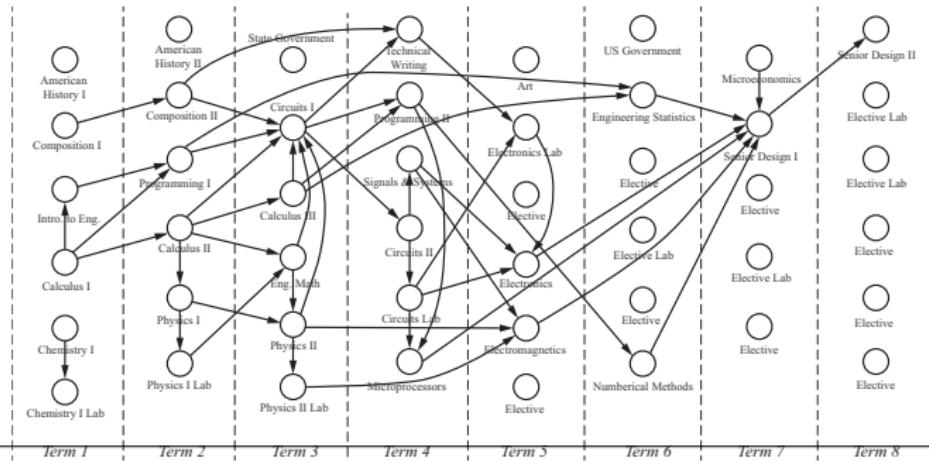
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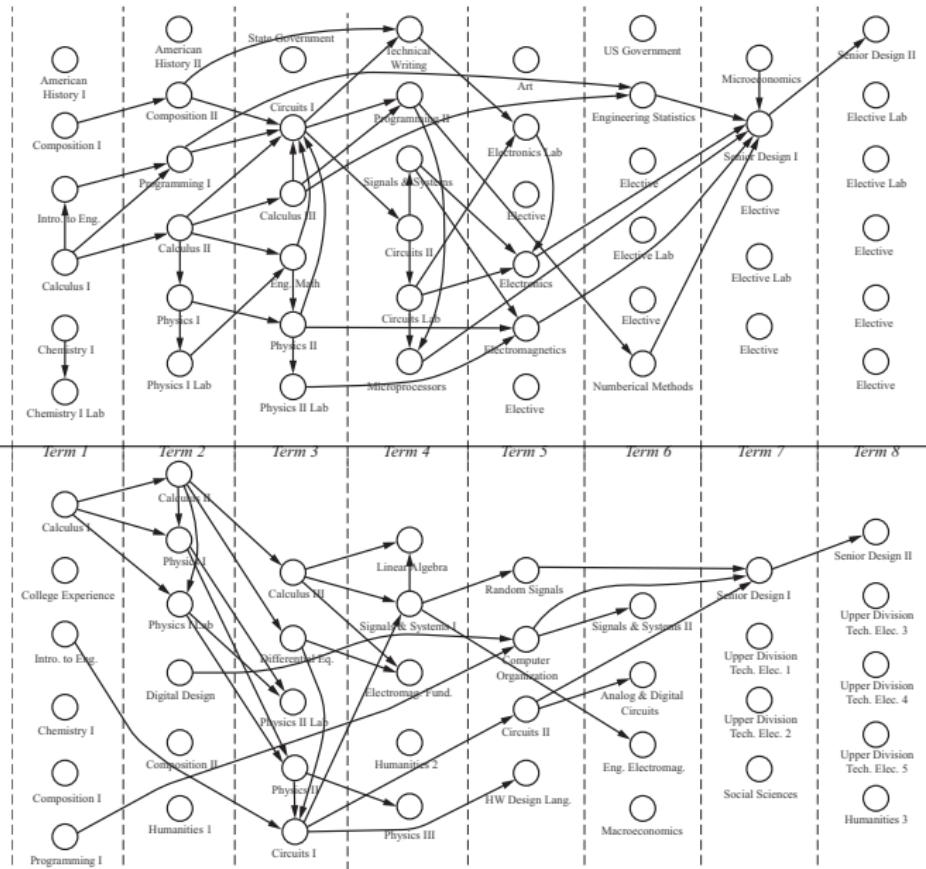
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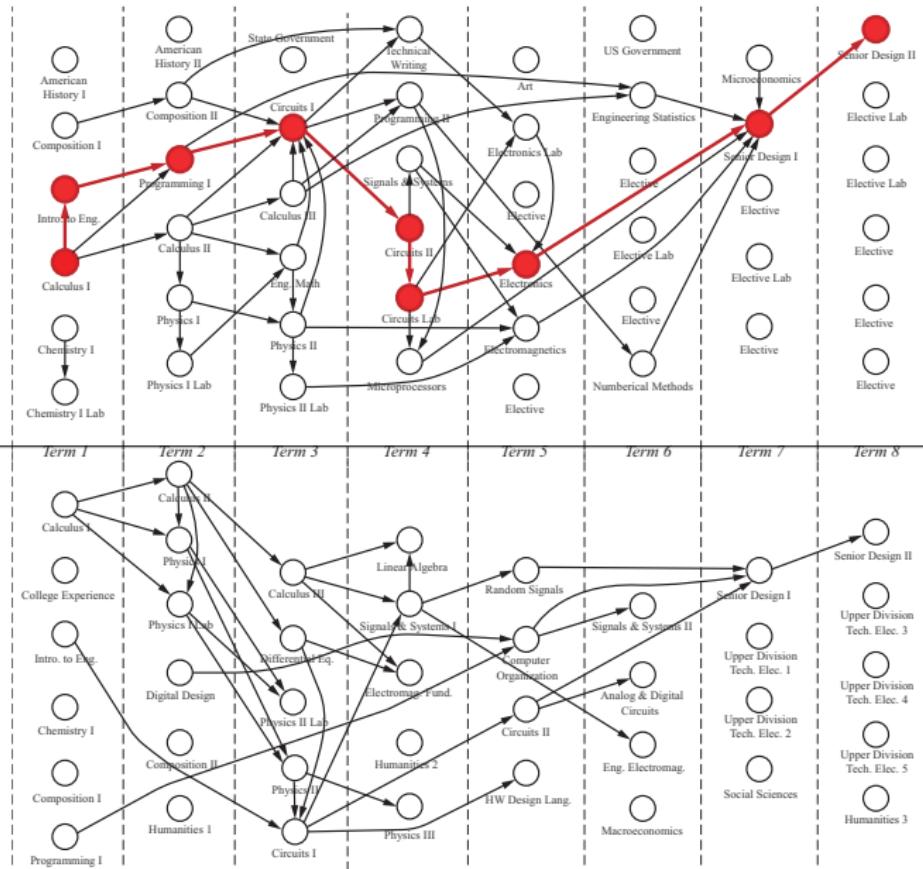
Analytics Journey



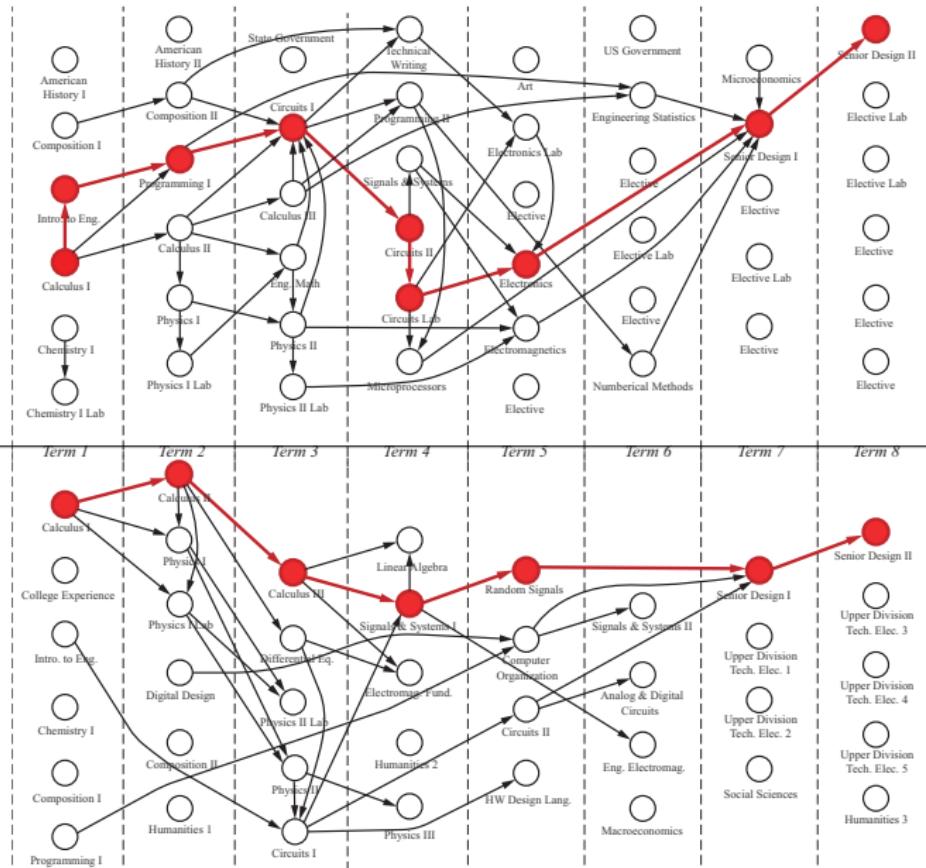
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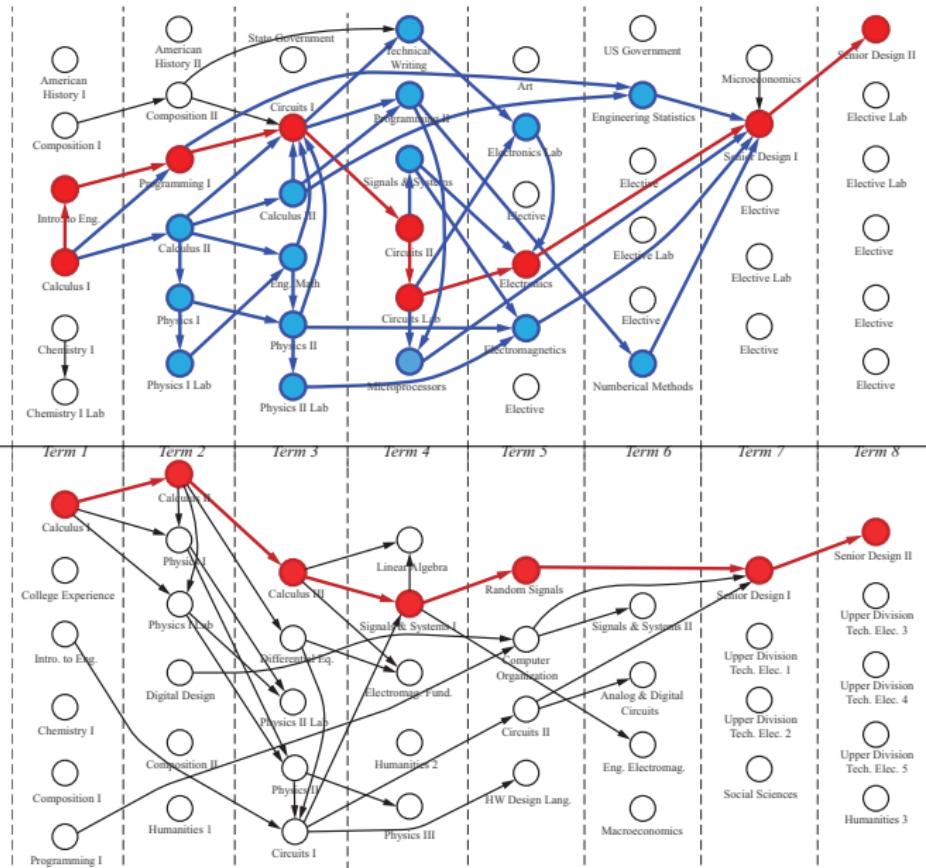
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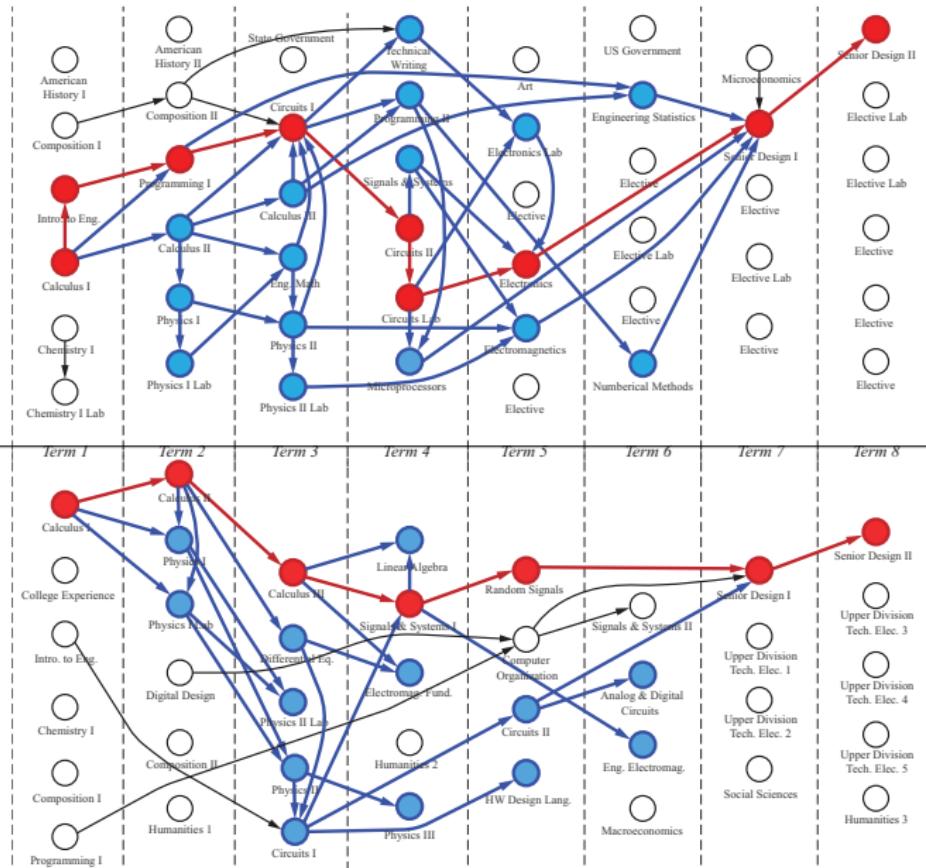
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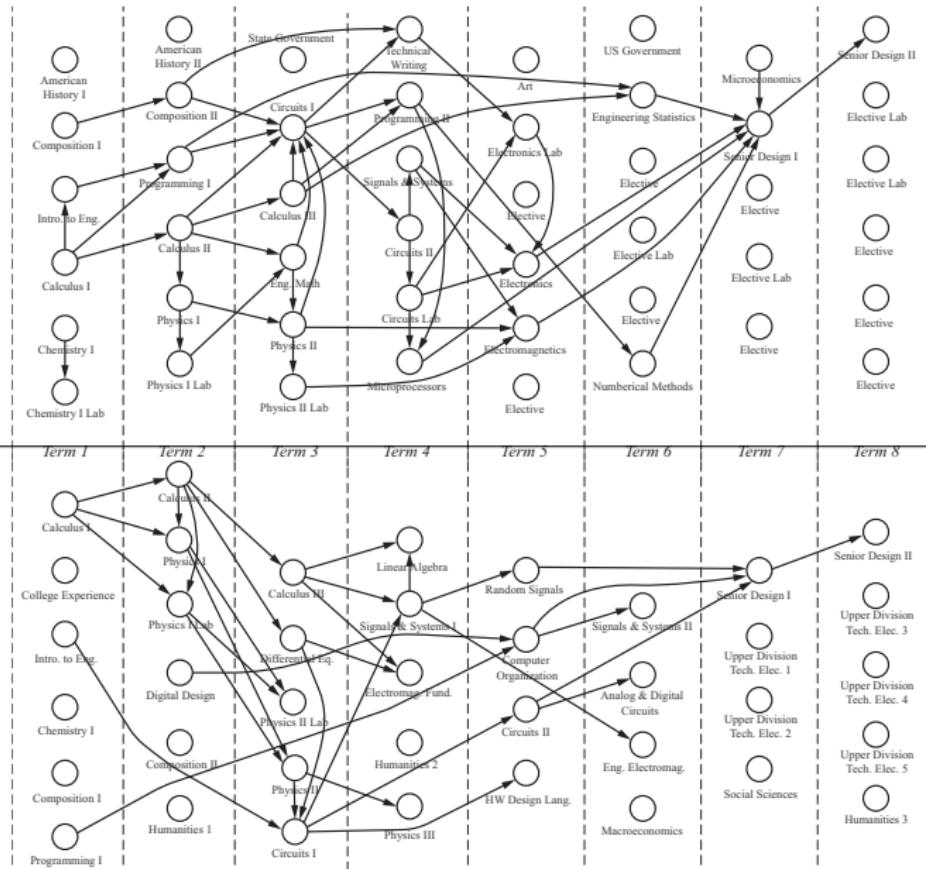
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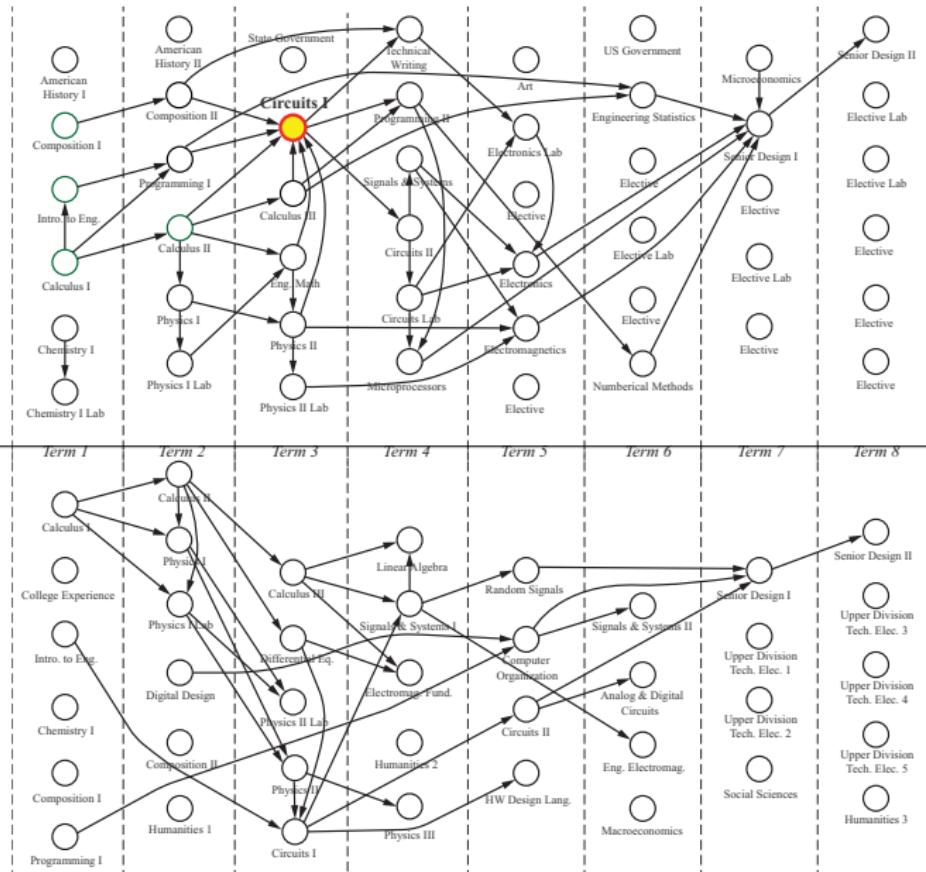
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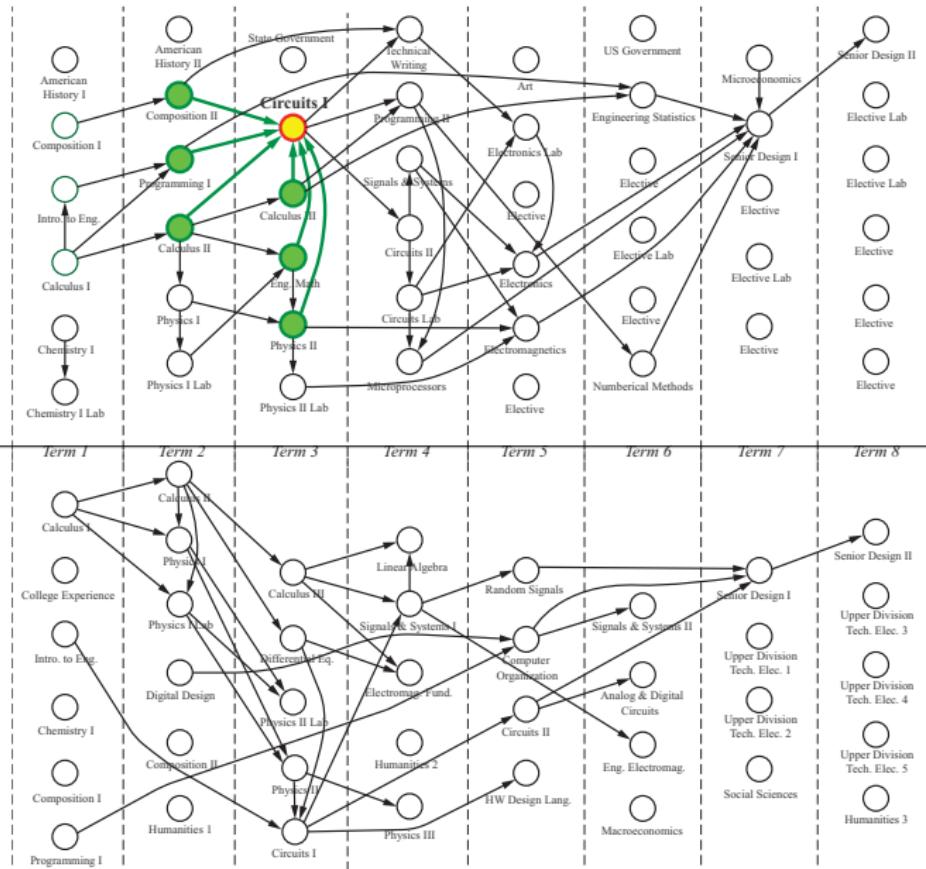
Analytics Journey



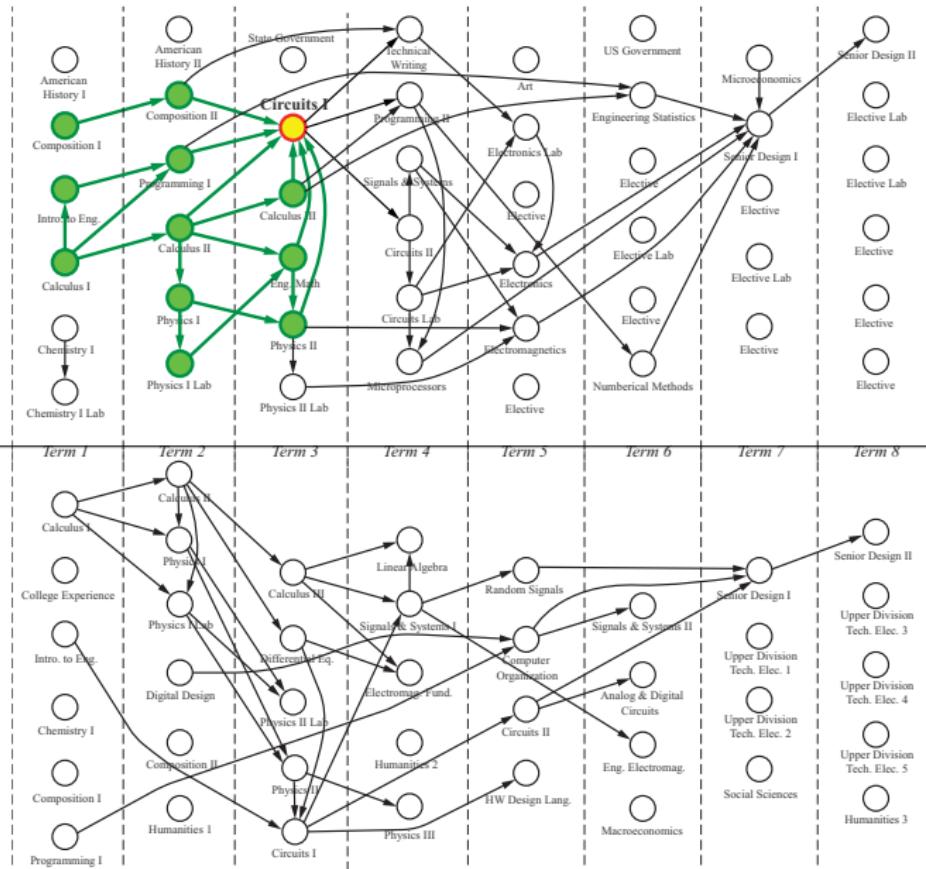
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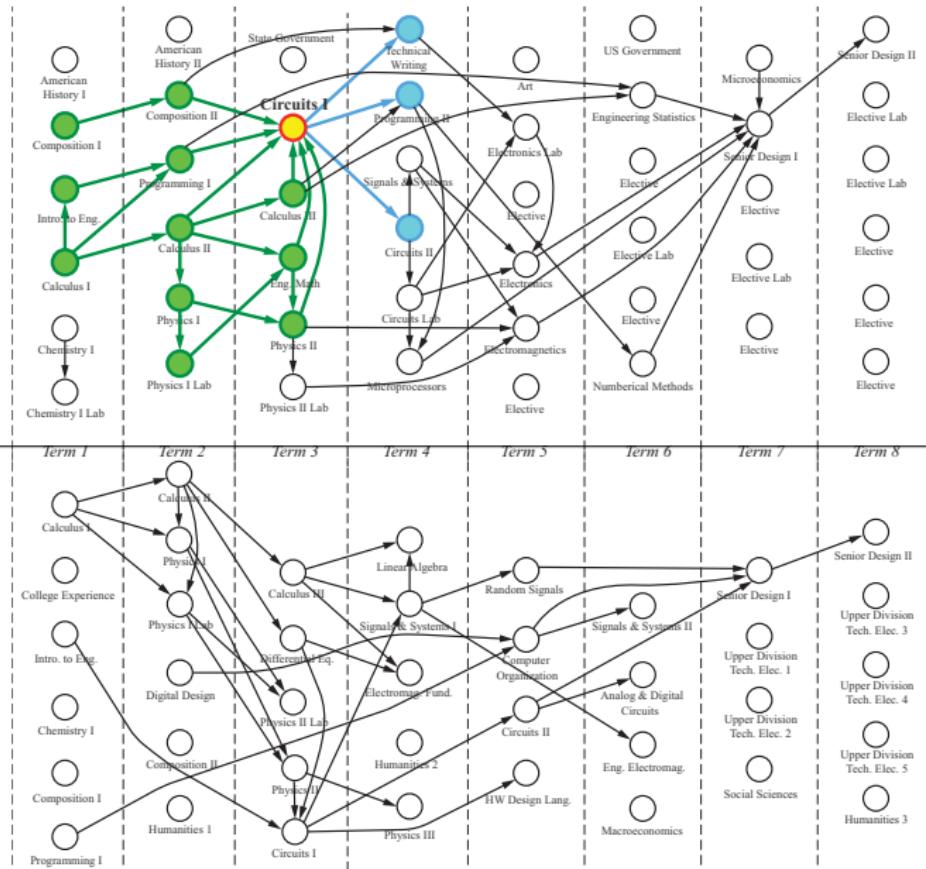
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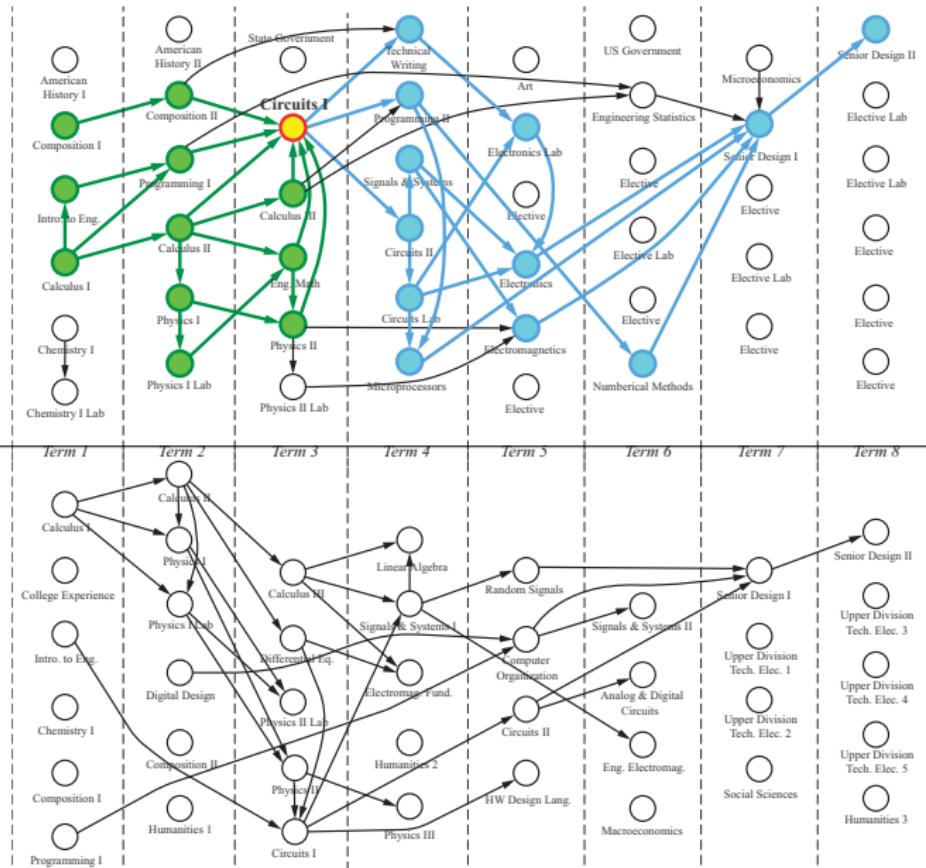
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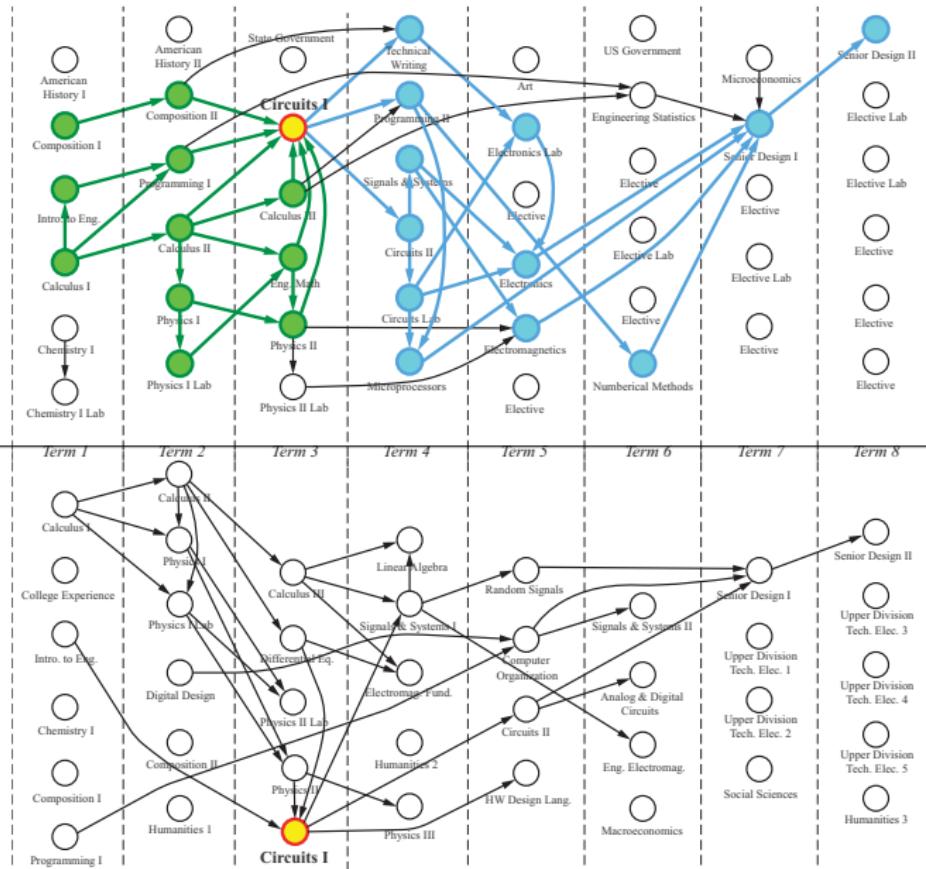
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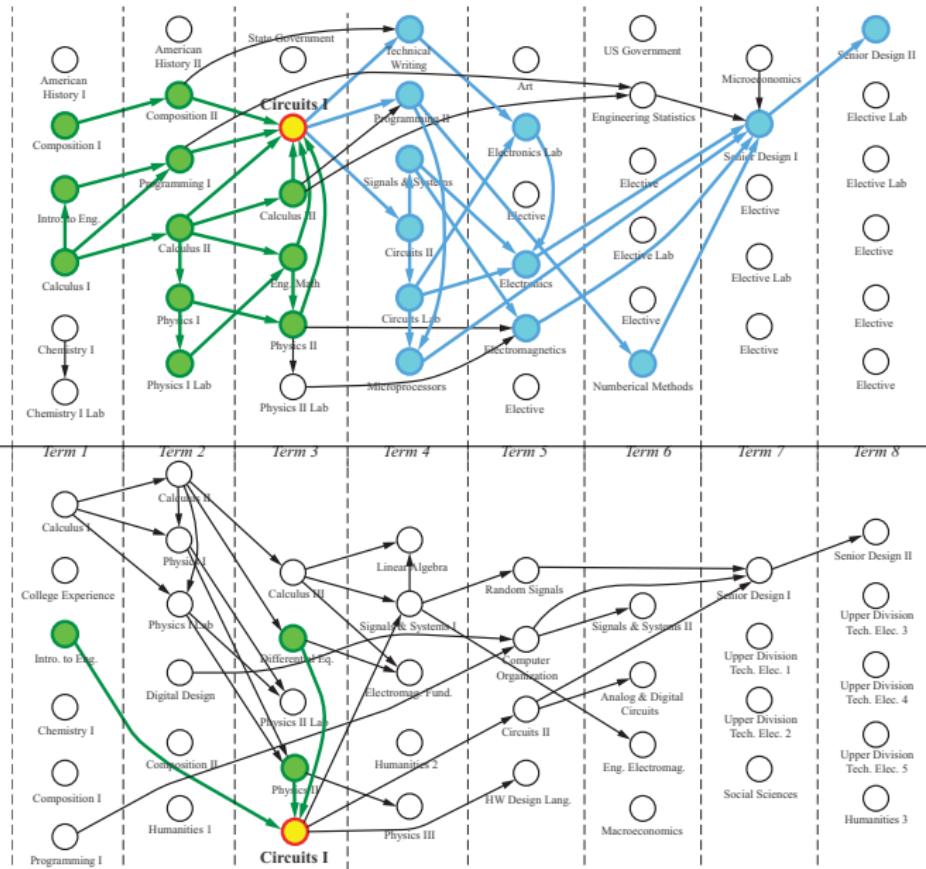
Analytics Journey



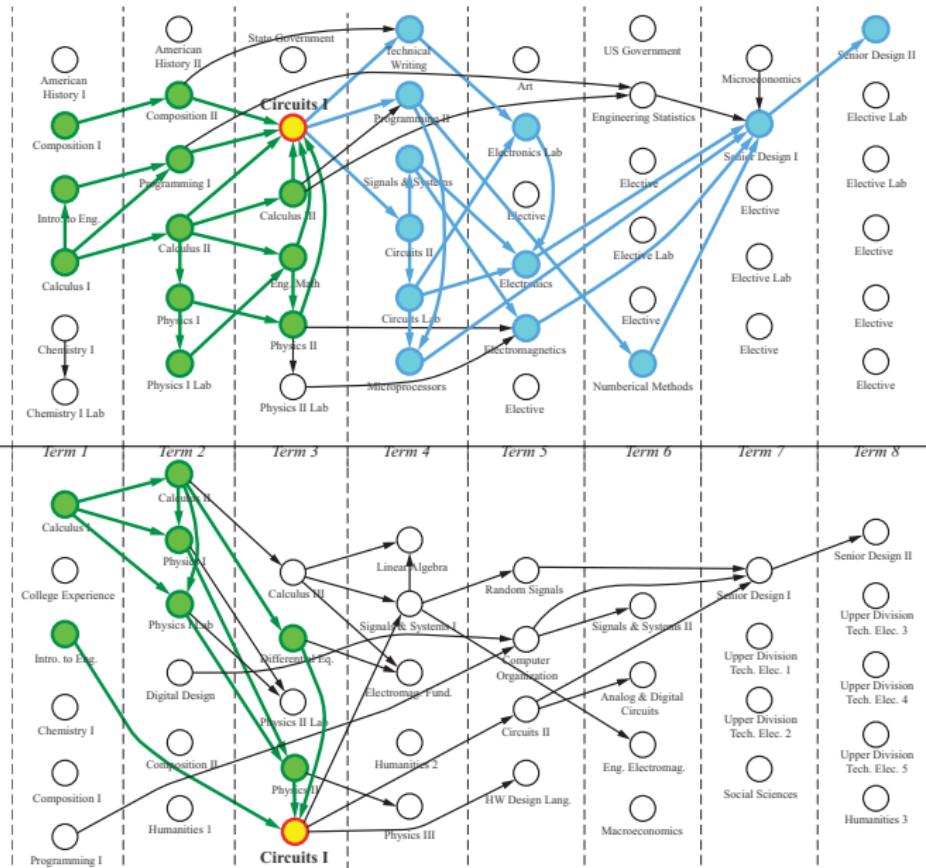
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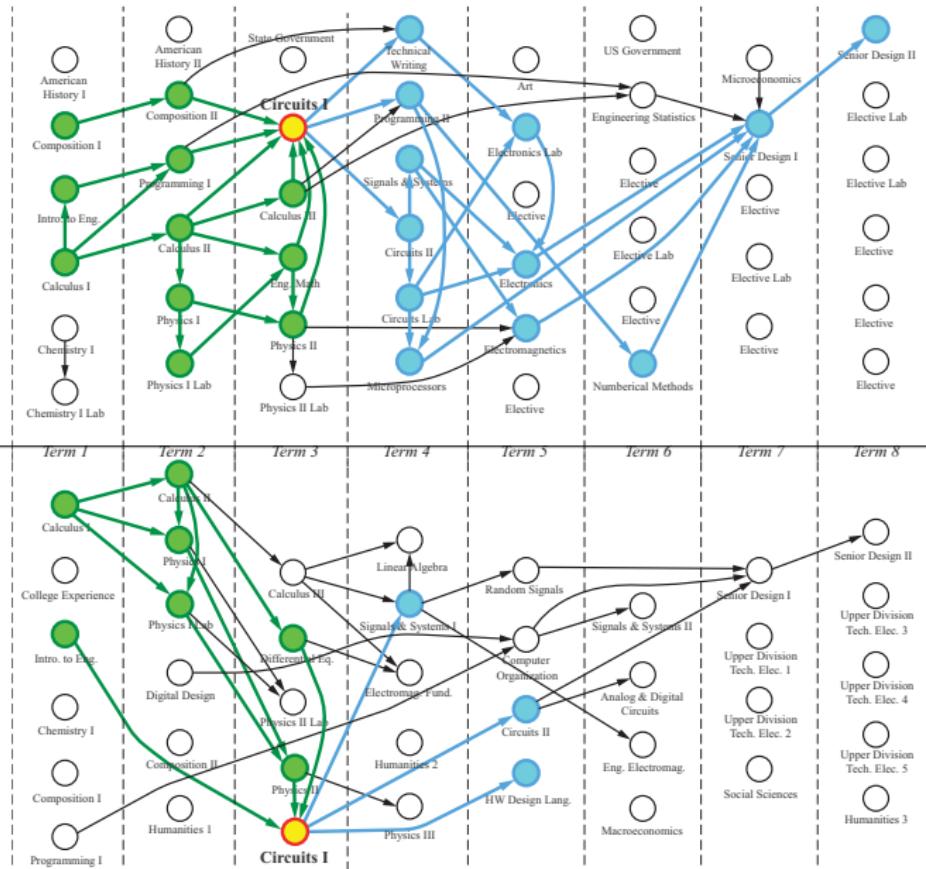
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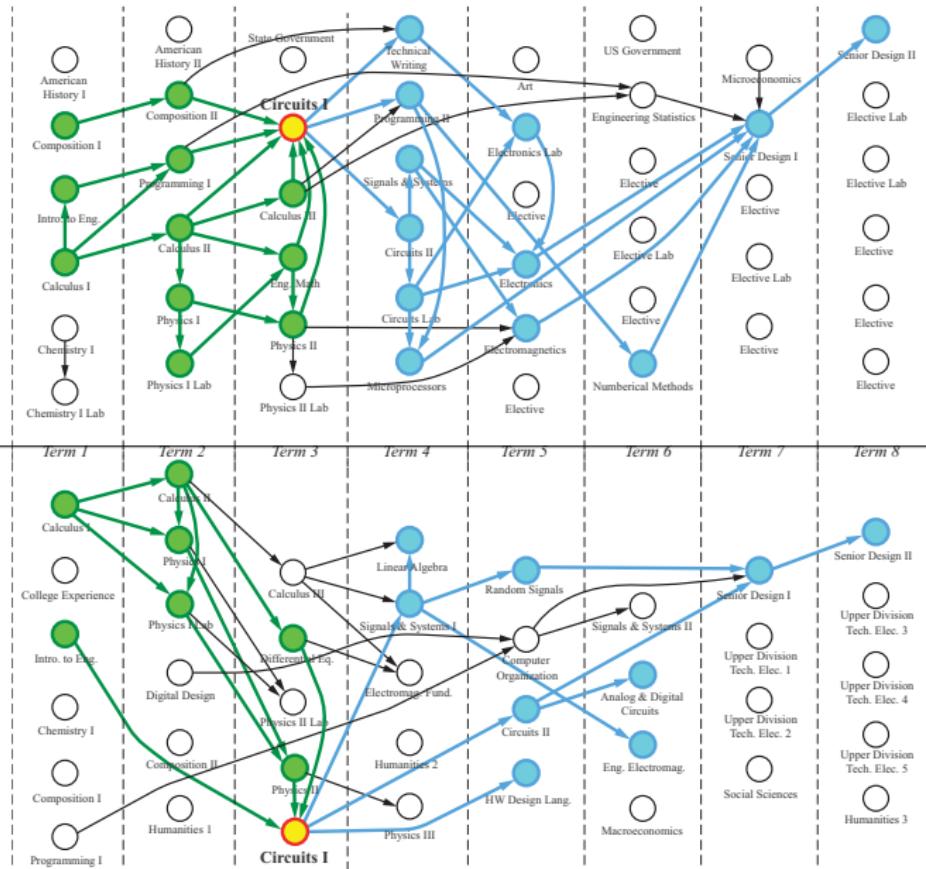
Analytics Journey



Analytics Journey



Analytics Journey



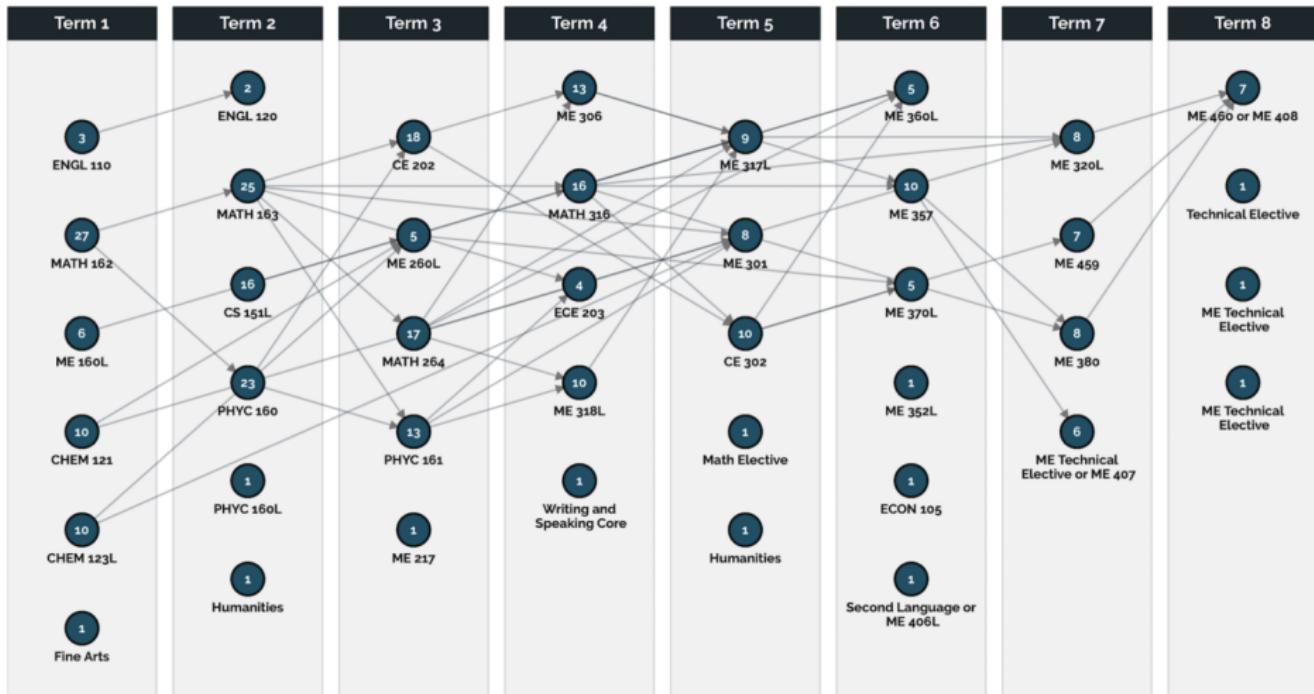
Analytics Journey

MECHANICAL ENGINEERING

University of New Mexico-Main Campus

CIP Program: Mechanical Engineering

Curricular Complexity: 314



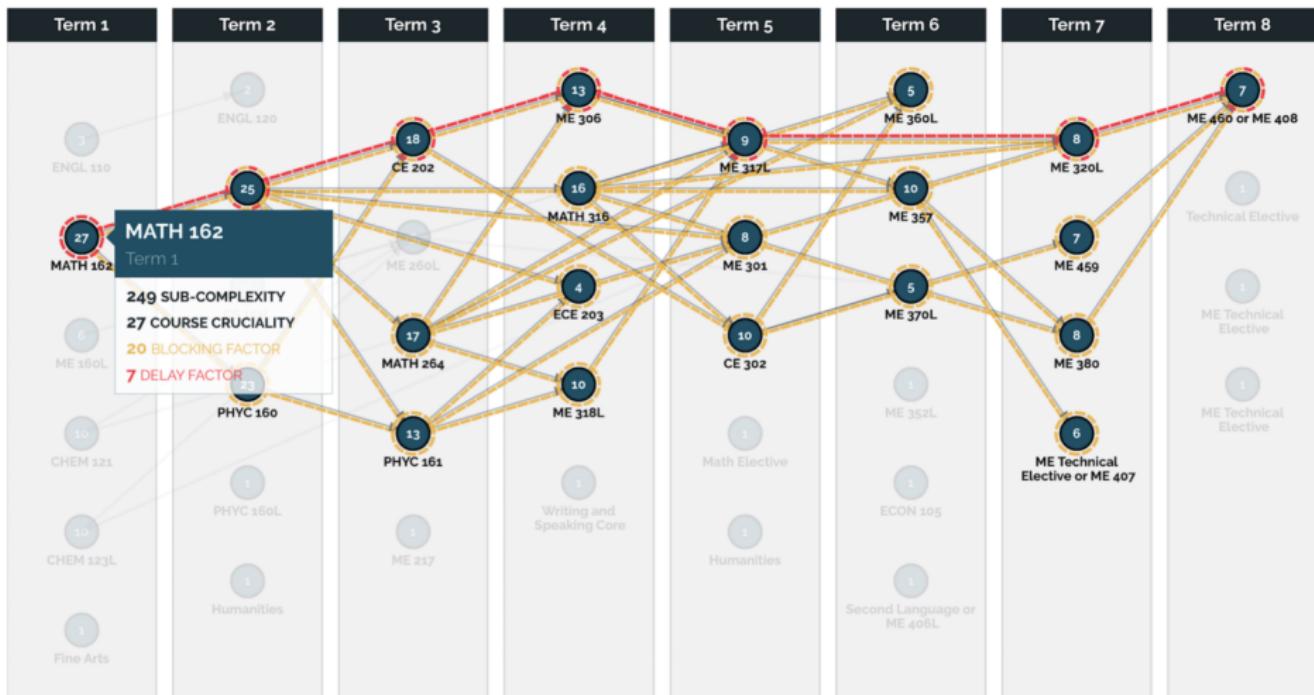
Analytics Journey

MECHANICAL ENGINEERING

University of New Mexico-Main Campus

CIP Program: Mechanical Engineering

Curricular Complexity: 314



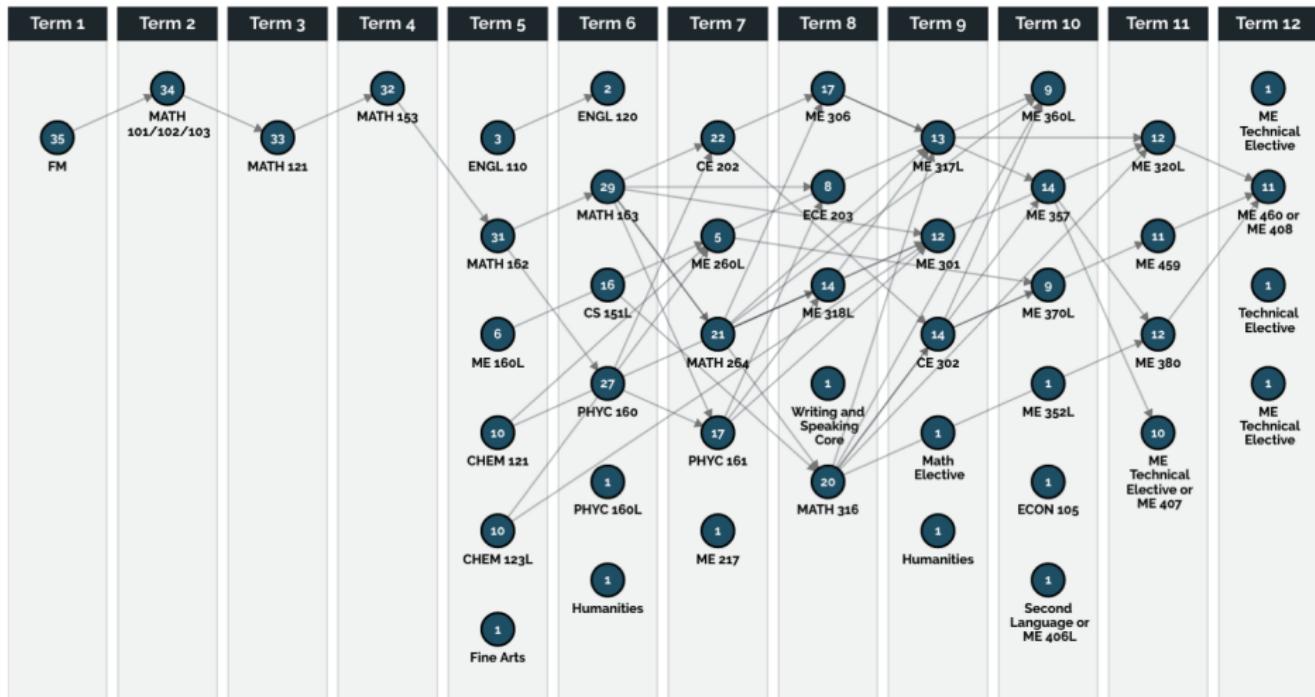
Analytics Journey

ME STARTING WITH FOUNDATIONAL MATH

University of New Mexico-Main Campus

CIP Program: Mechanical Engineering

Curricular Complexity: 532



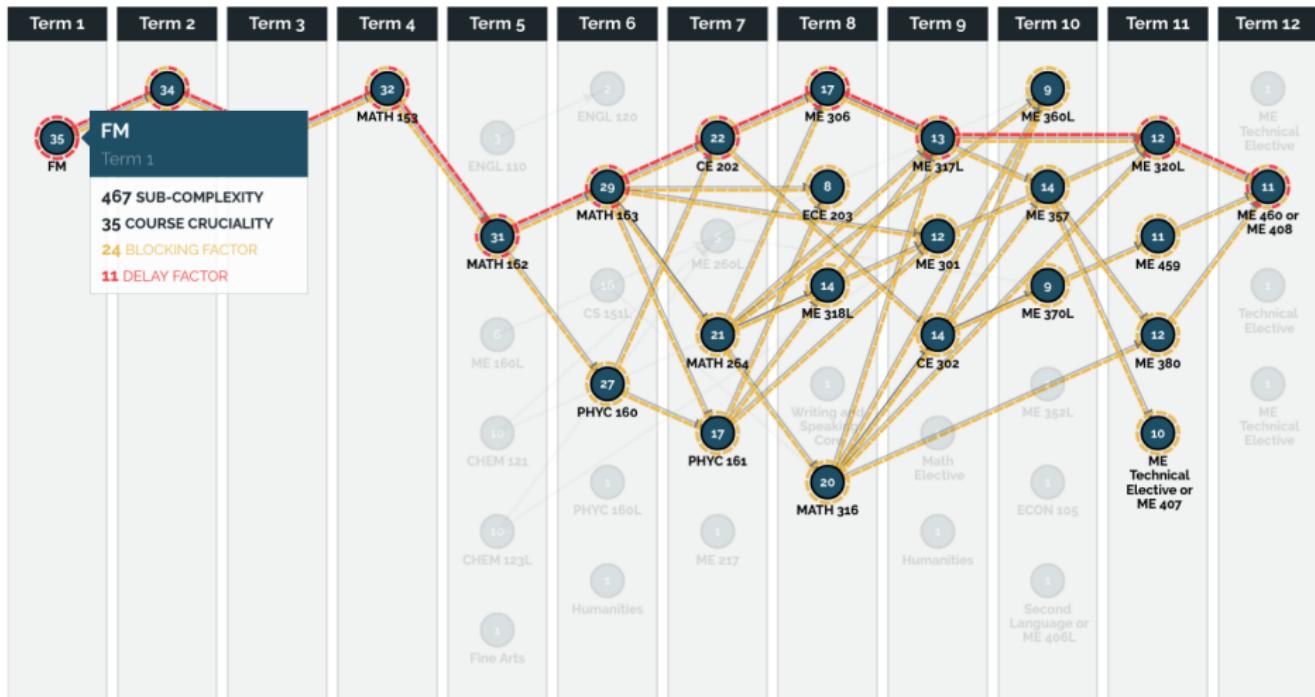
Analytics Journey

ME STARTING WITH FOUNDATIONAL MATH

University of New Mexico-Main Campus

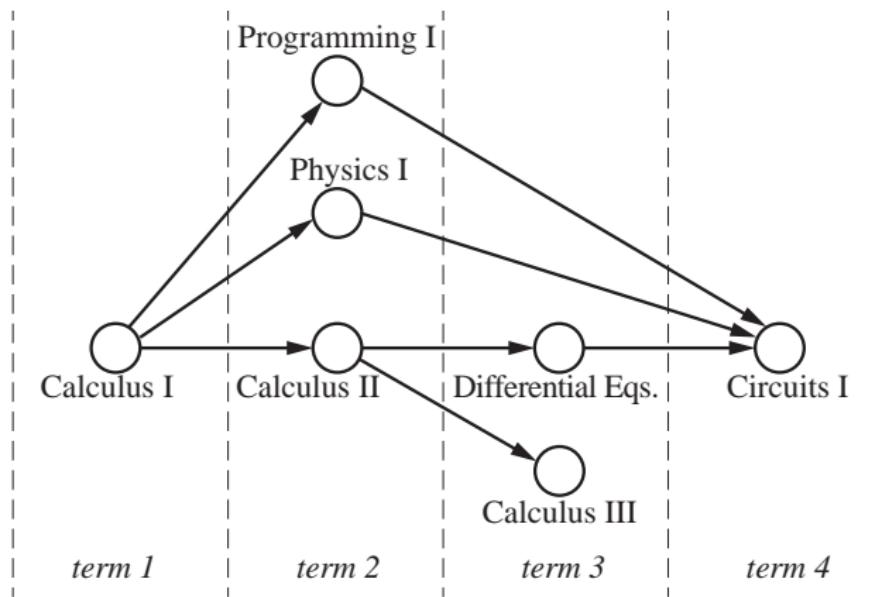
CIP Program: Mechanical Engineering

Curricular Complexity: 532



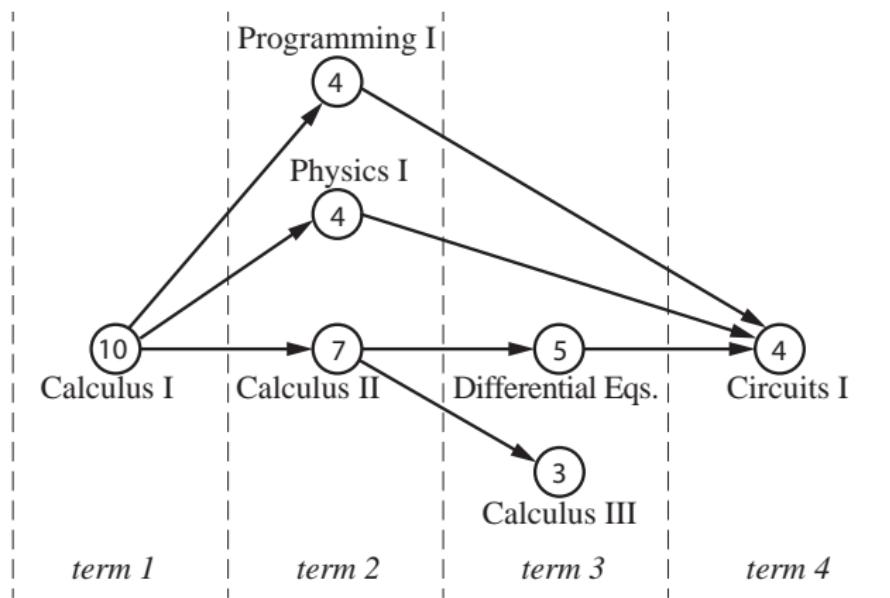
Analytics Journey

A curricular pattern for Circuits I (Calc ready):



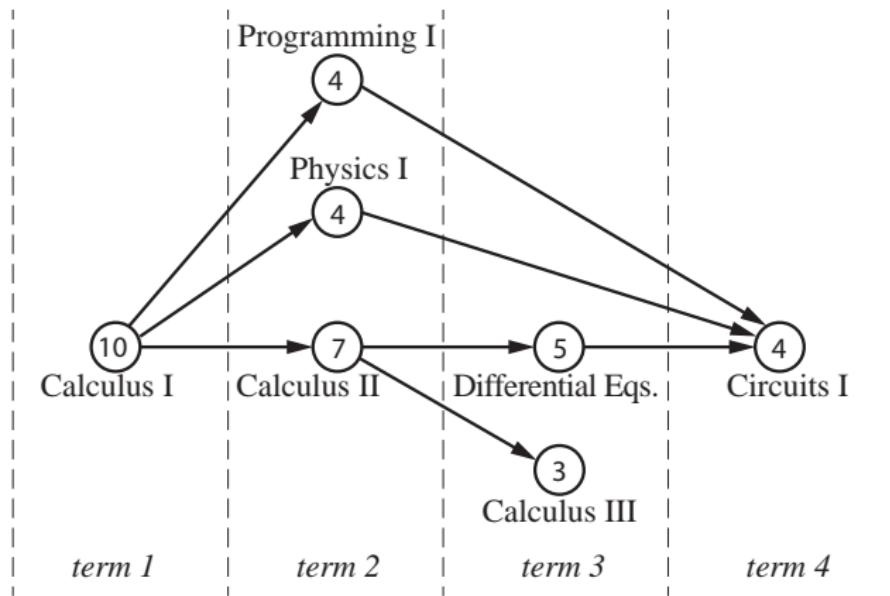
Analytics Journey

A curricular pattern for Circuits I (Calc ready):



Analytics Journey

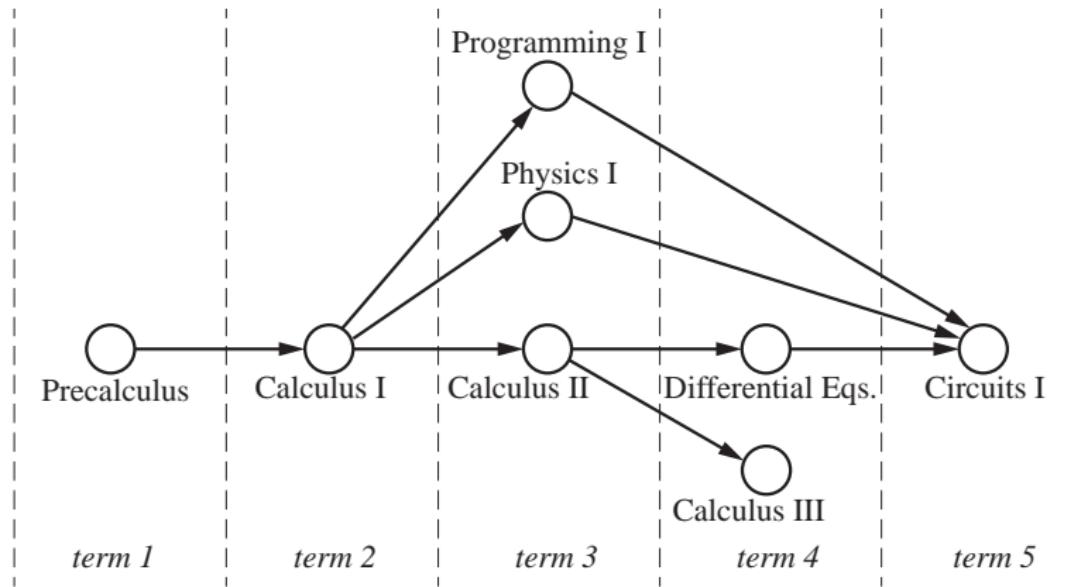
A curricular pattern for Circuits I (Calc ready):



Structural Complexity = 37

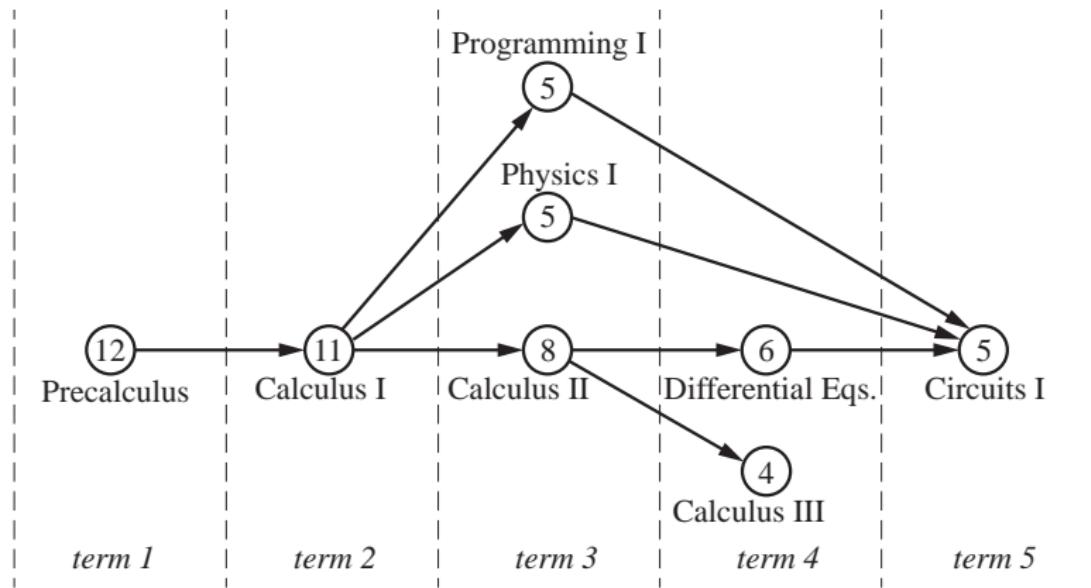
Analytics Journey

A curricular pattern for Circuits I (not Calc ready):



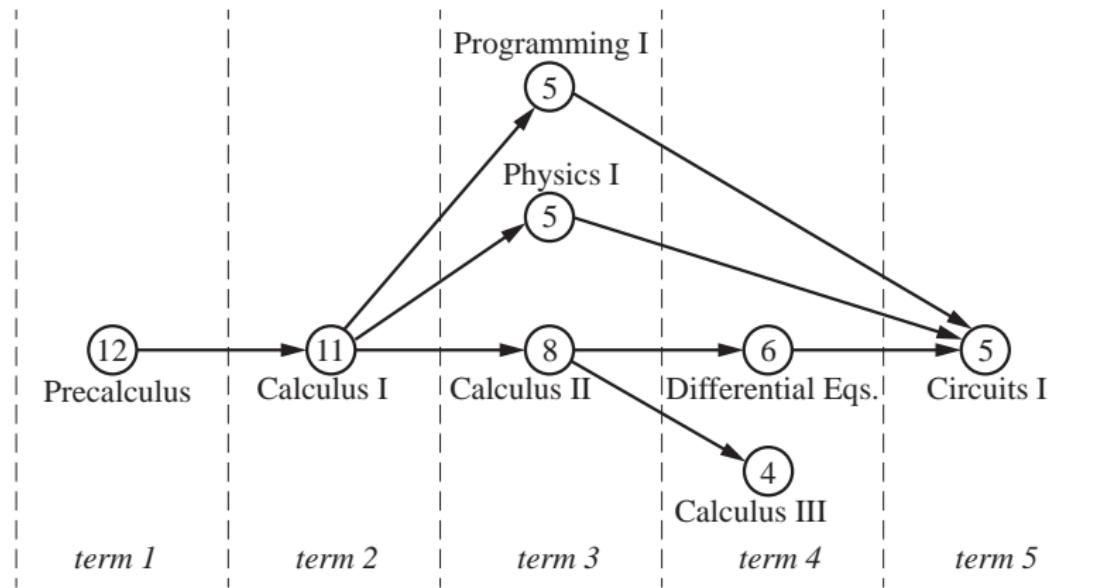
Analytics Journey

A curricular pattern for Circuits I (not Calc ready):



Analytics Journey

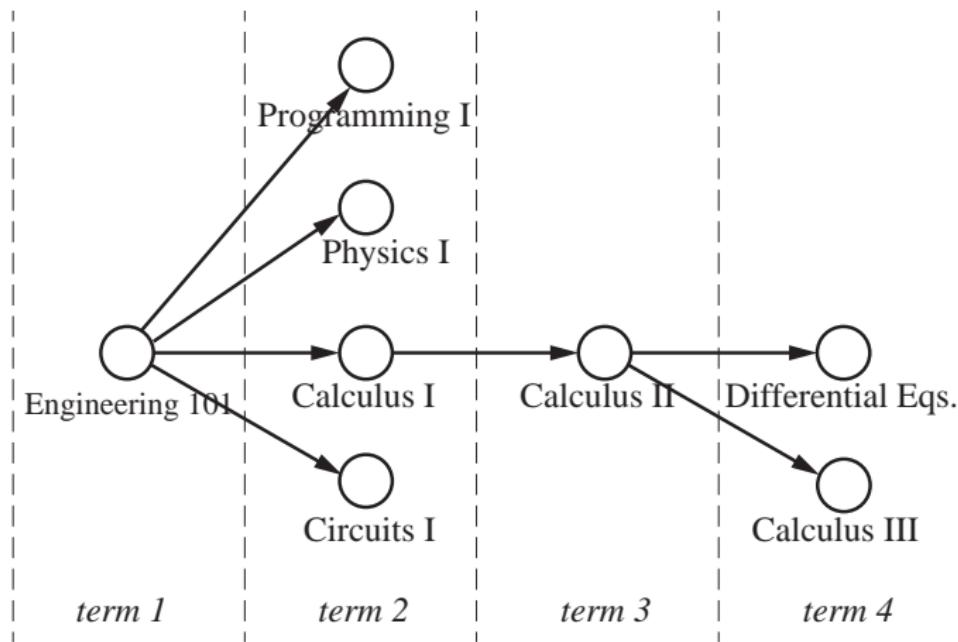
A curricular pattern for Circuits I (not Calc ready):



Structural Complexity = 56

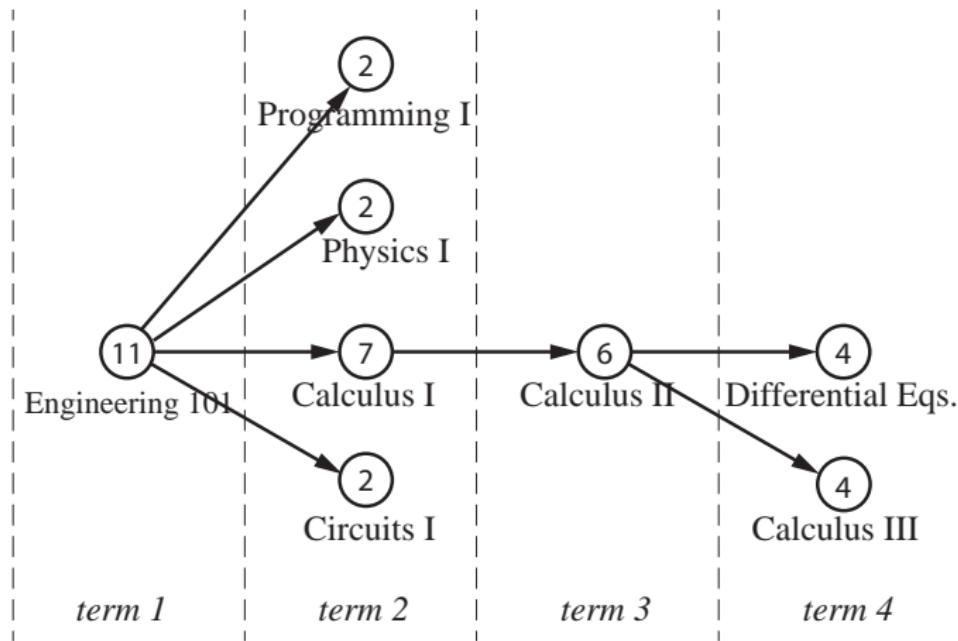
Analytics Journey

Redesigning the pattern:



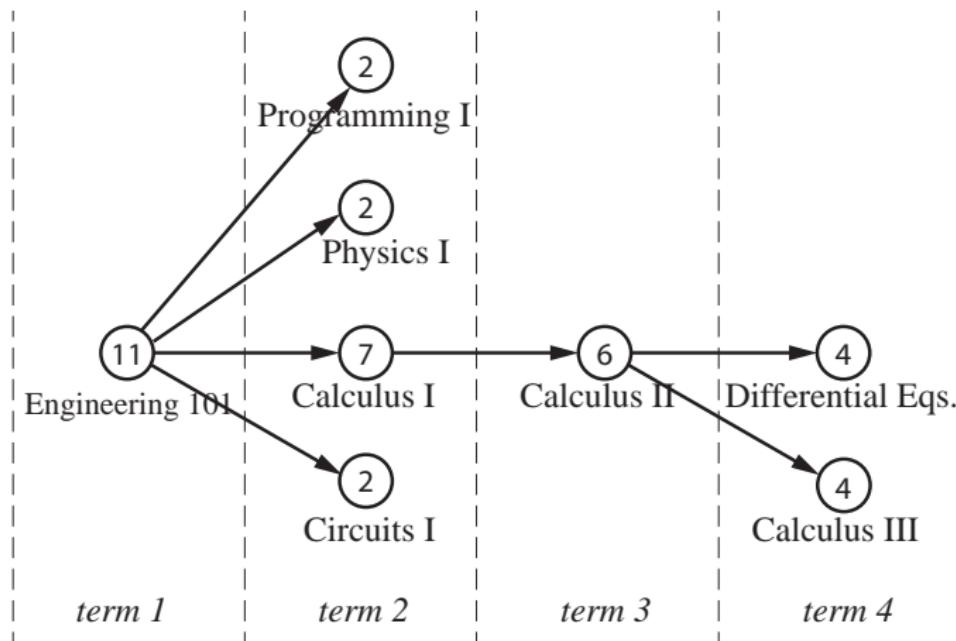
Analytics Journey

Redesigning the pattern:



Analytics Journey

Redesigning the pattern:



Structural Complexity = 34

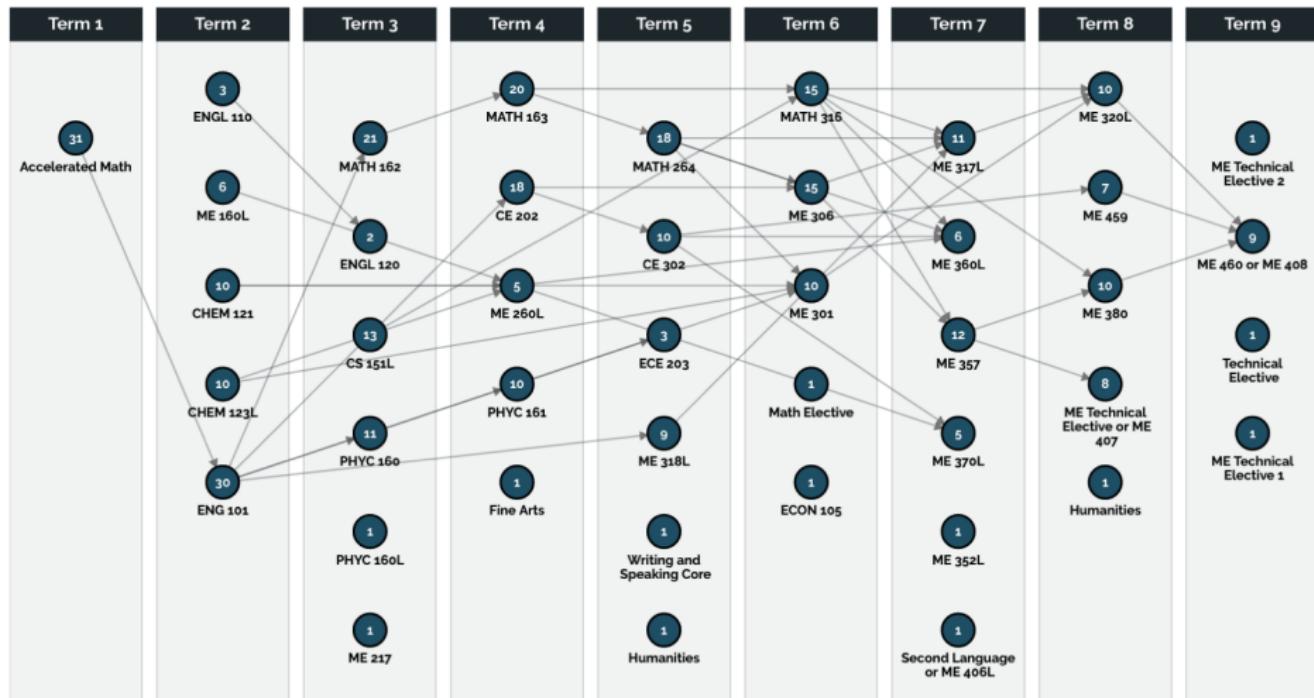
Analytics Journey

ME WITH ENG 101

University of New Mexico-Main Campus

CIP Program: Mechanical Engineering

Curricular Complexity: 361



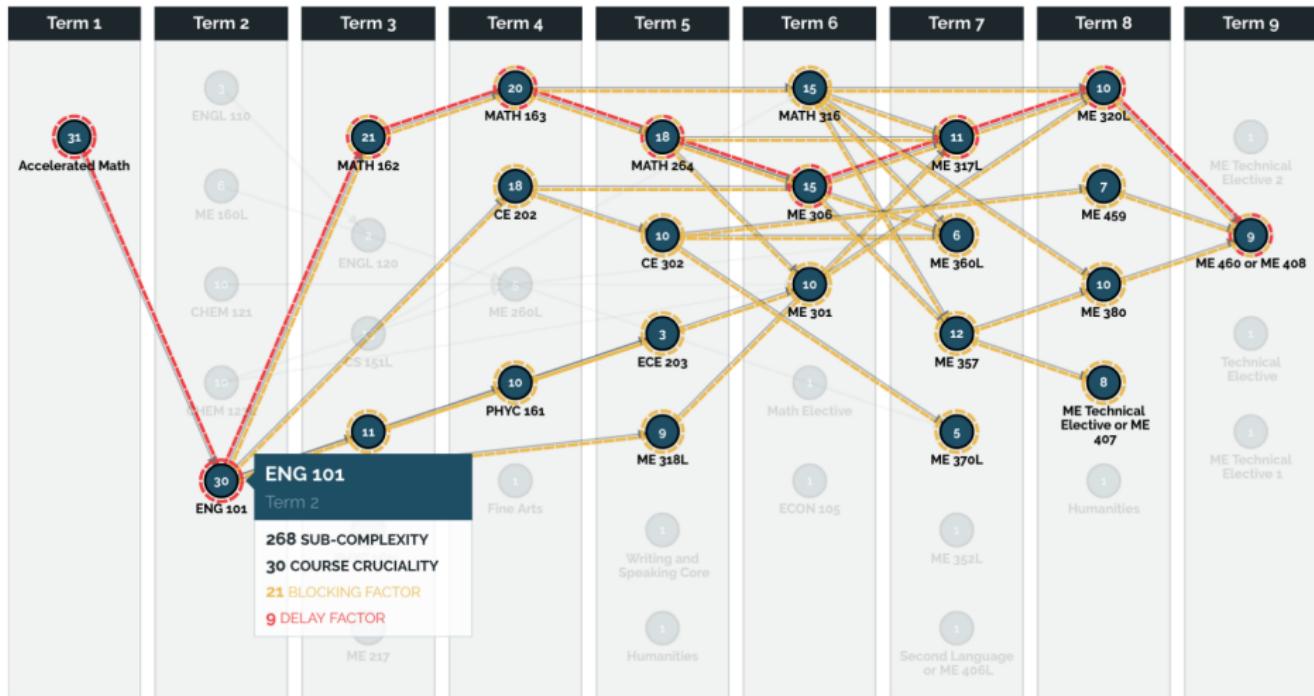
Analytics Journey

ME WITH ENG 101

University of New Mexico-Main Campus

CIP Program: Mechanical Engineering

Curricular Complexity: 361



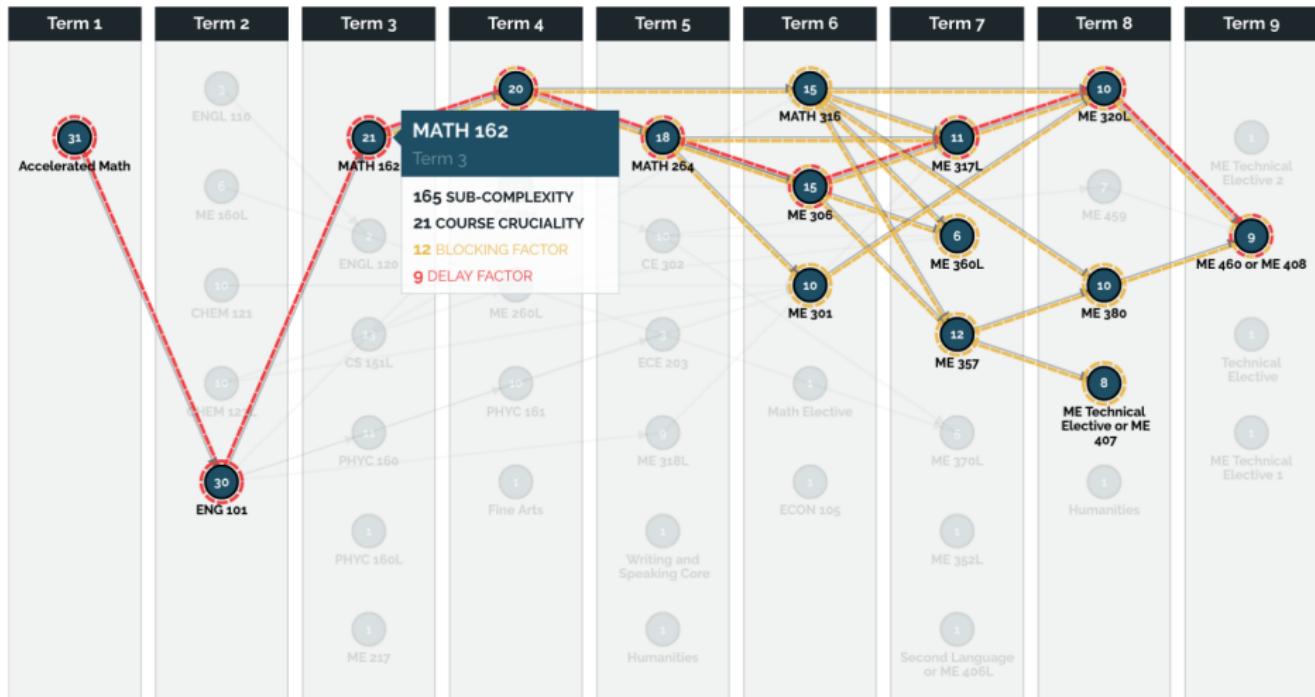
Analytics Journey

ME WITH ENG 101

University of New Mexico-Main Campus

CIP Program: Mechanical Engineering

Curricular Complexity: 361



Analytics Journey

Simulation Assumptions:

- Students not calculus ready.
- Instructional complexity is the same for both patterns
- At most three courses in the pattern per term.
- When a class is not passed, it is attempted again in the next semester.
- Success: completion within 7 terms.

Analytics Journey

Simulation Assumptions:

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- At most three courses in the pattern per term.
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Use historic pass rate data:

- Traditional: 79% success
- Alternative: 88% success

Analytics Journey

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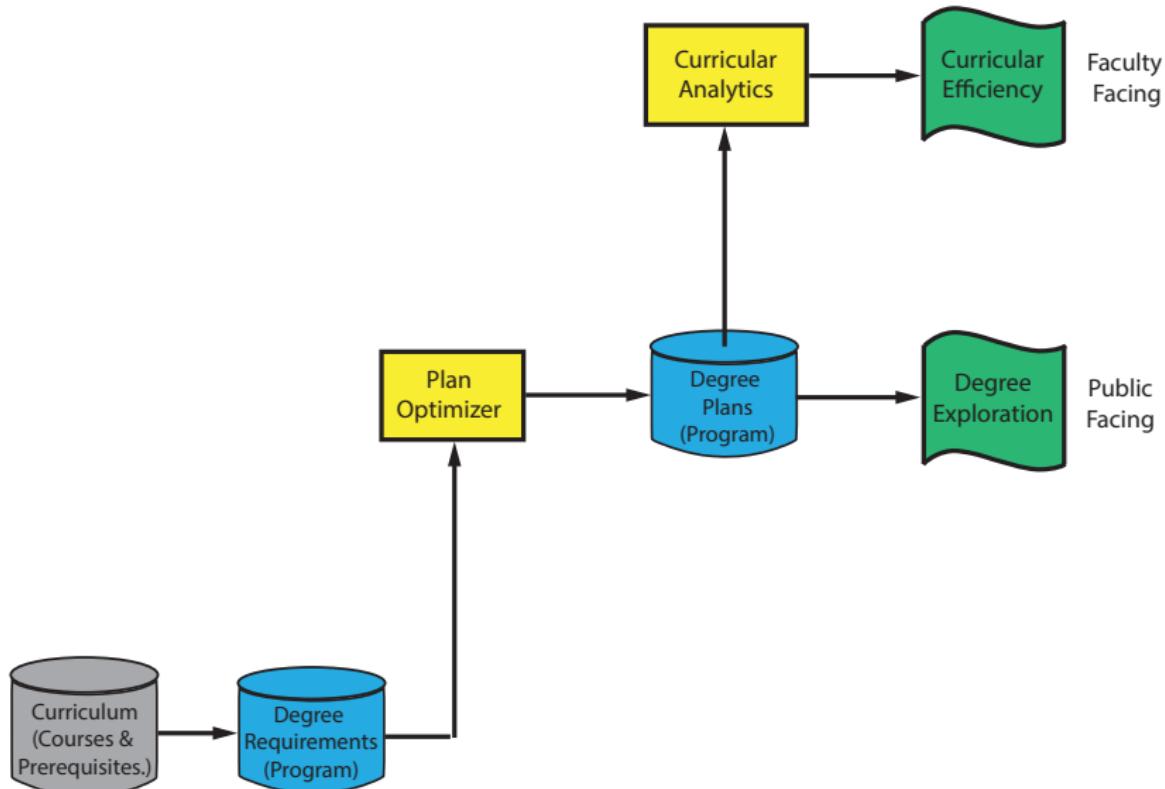
Use historic pass rate data:

- Traditional: 79% success
- Alternative: 88% success

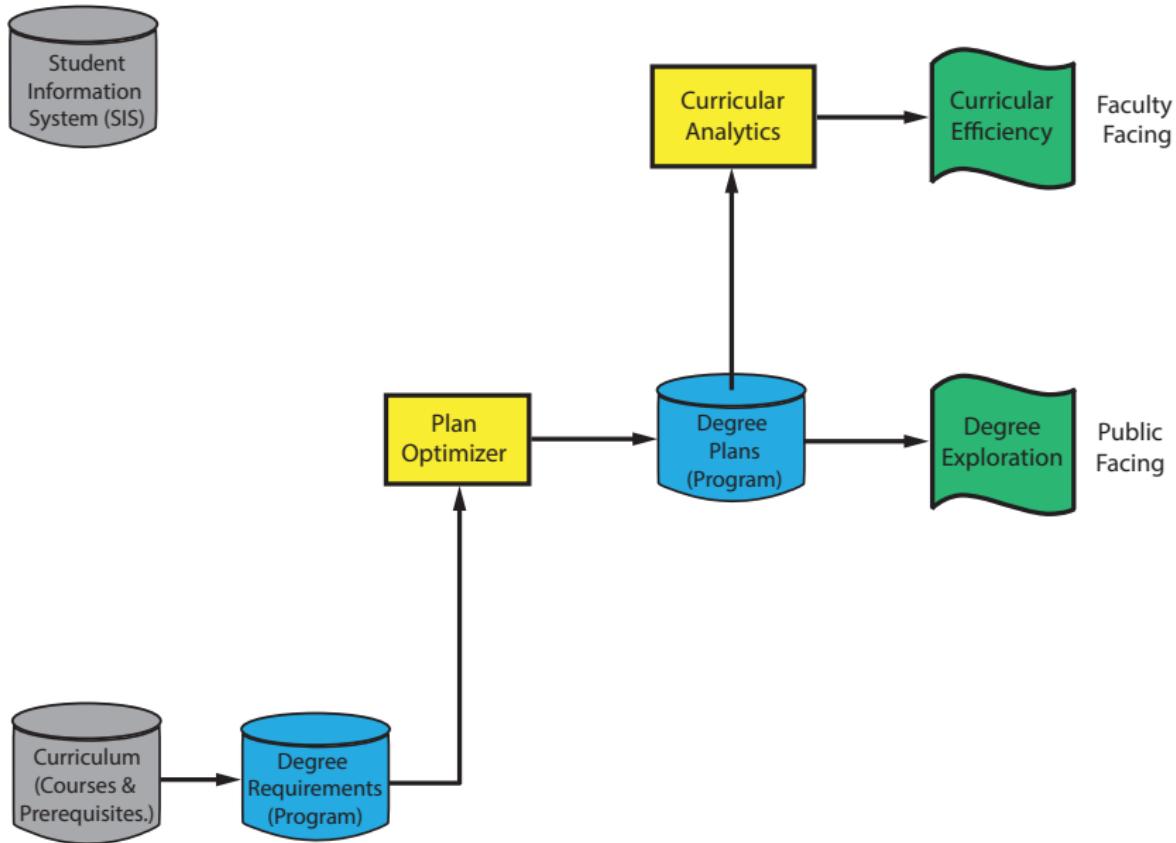
90% pass rate in ENG 101:

- Alternative: 98% success

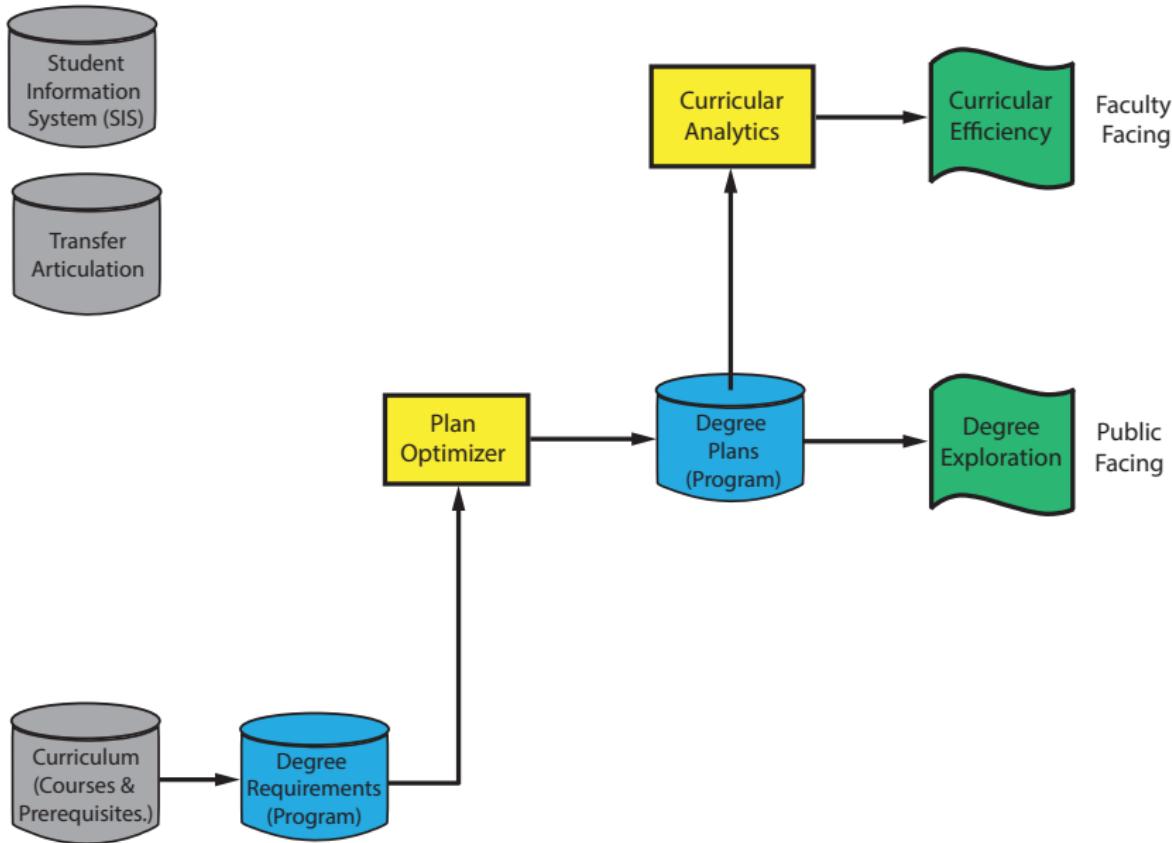
Analytics Journey



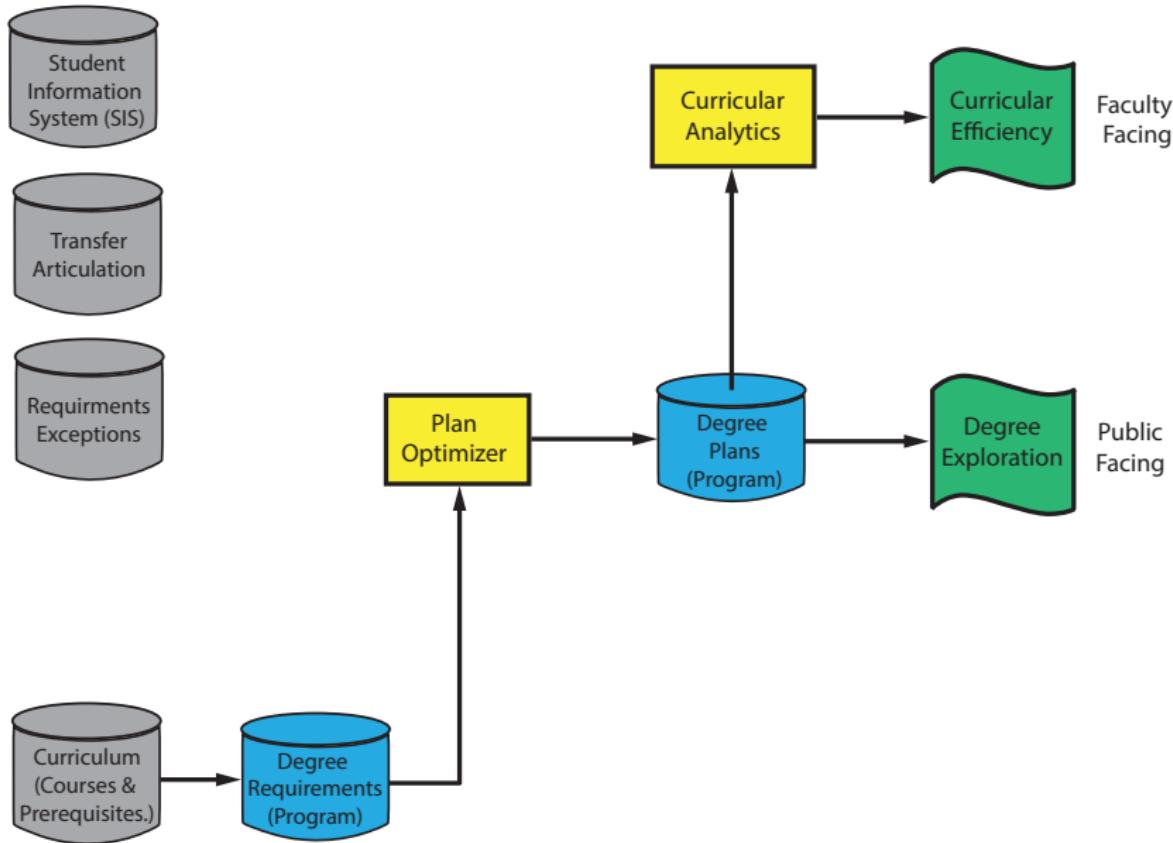
Analytics Journey



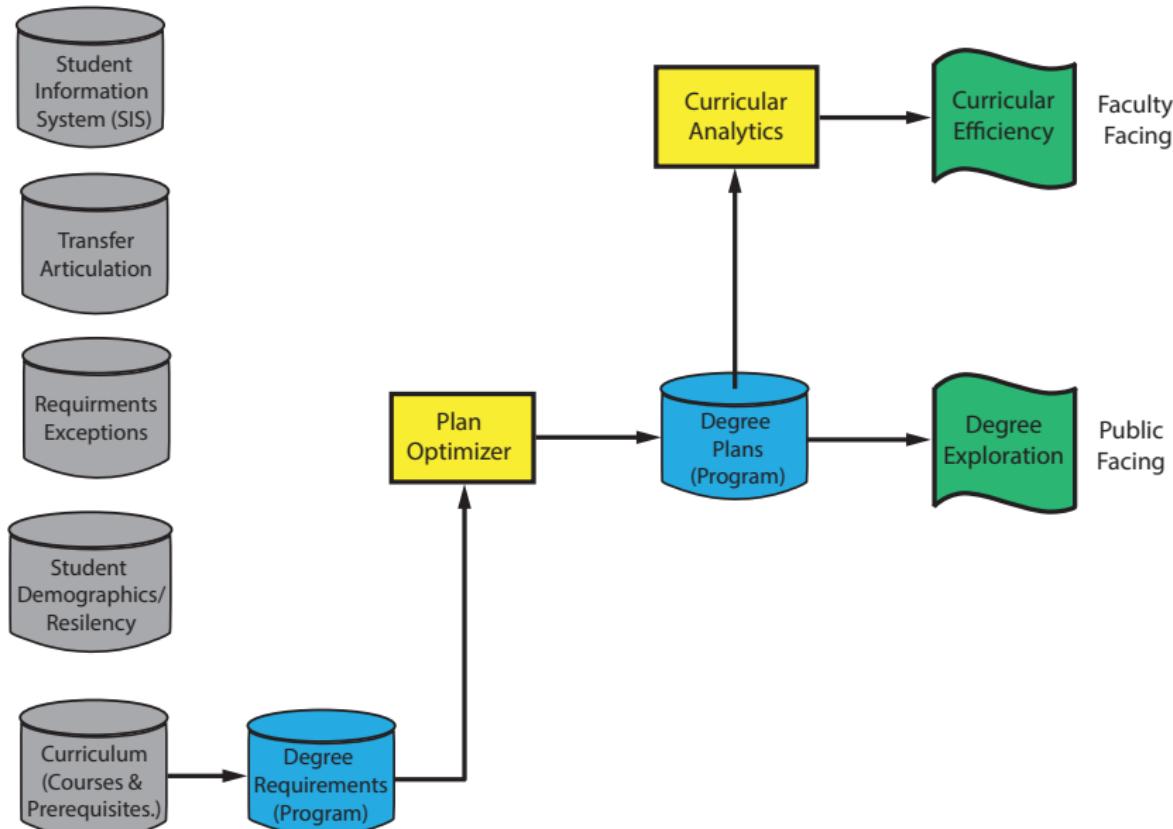
Analytics Journey



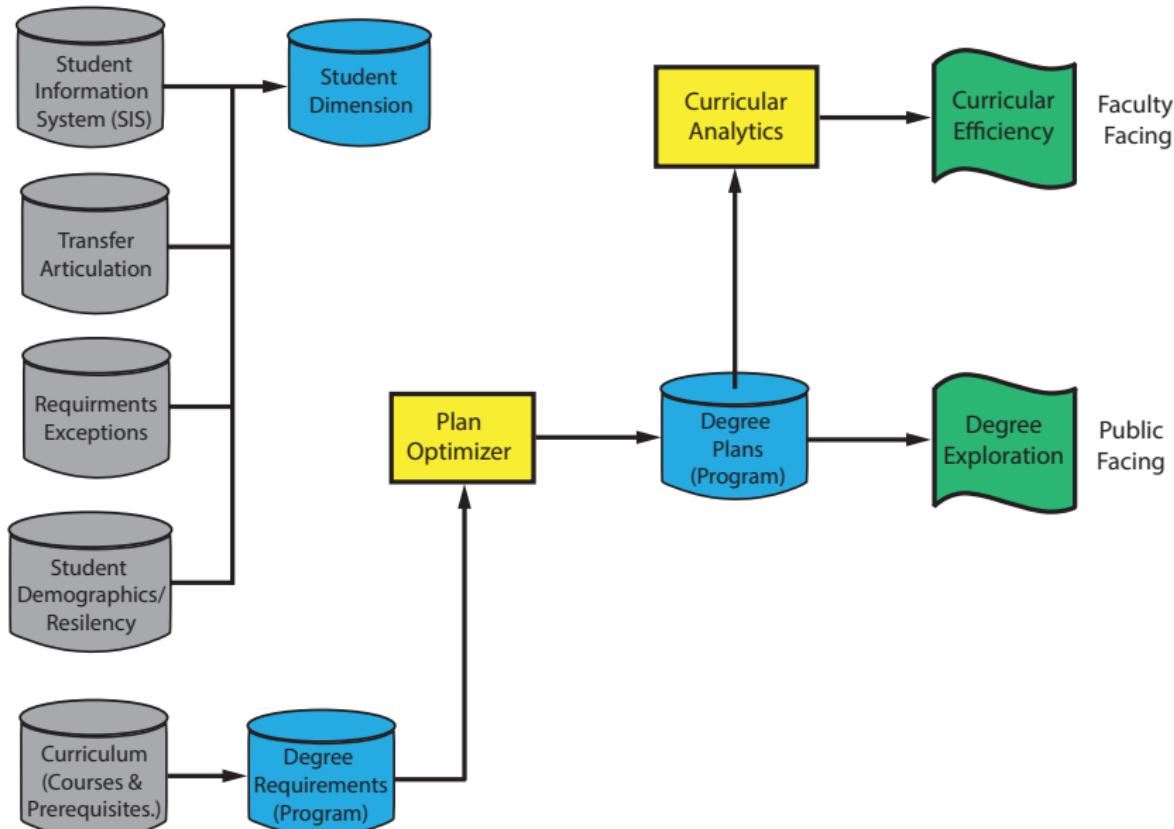
Analytics Journey



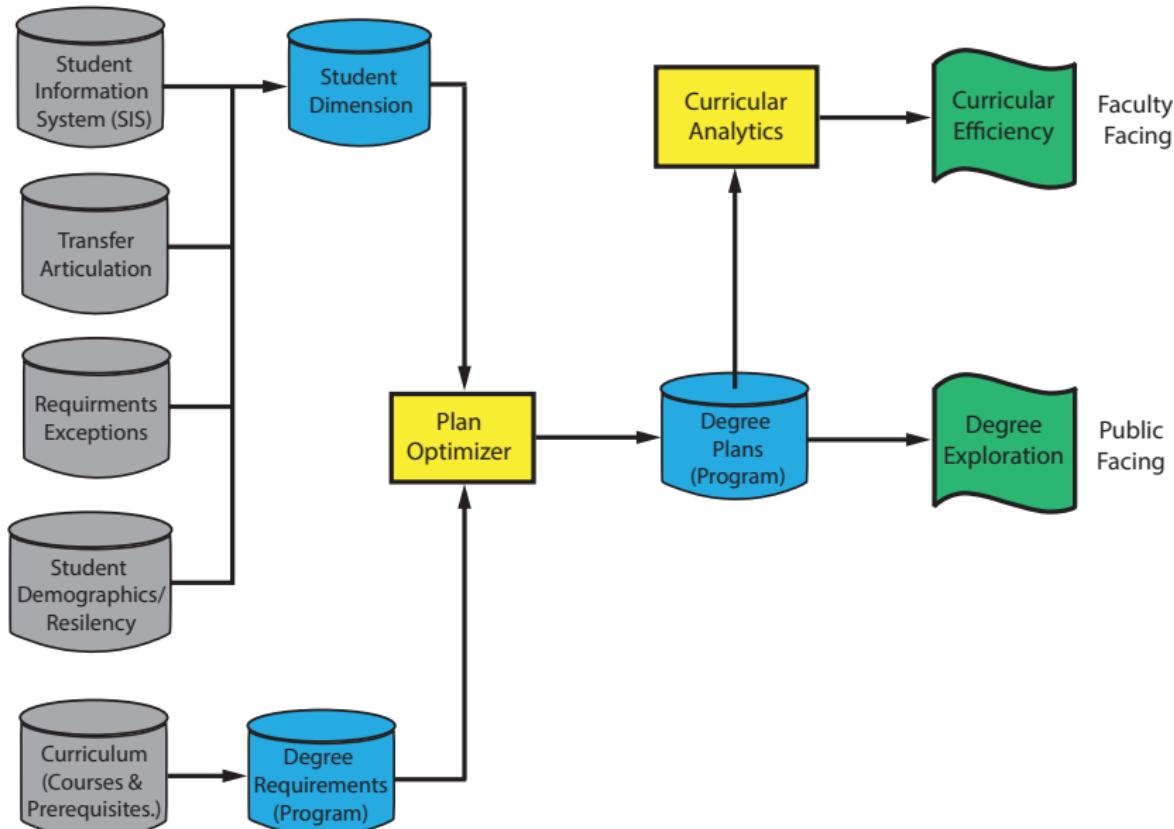
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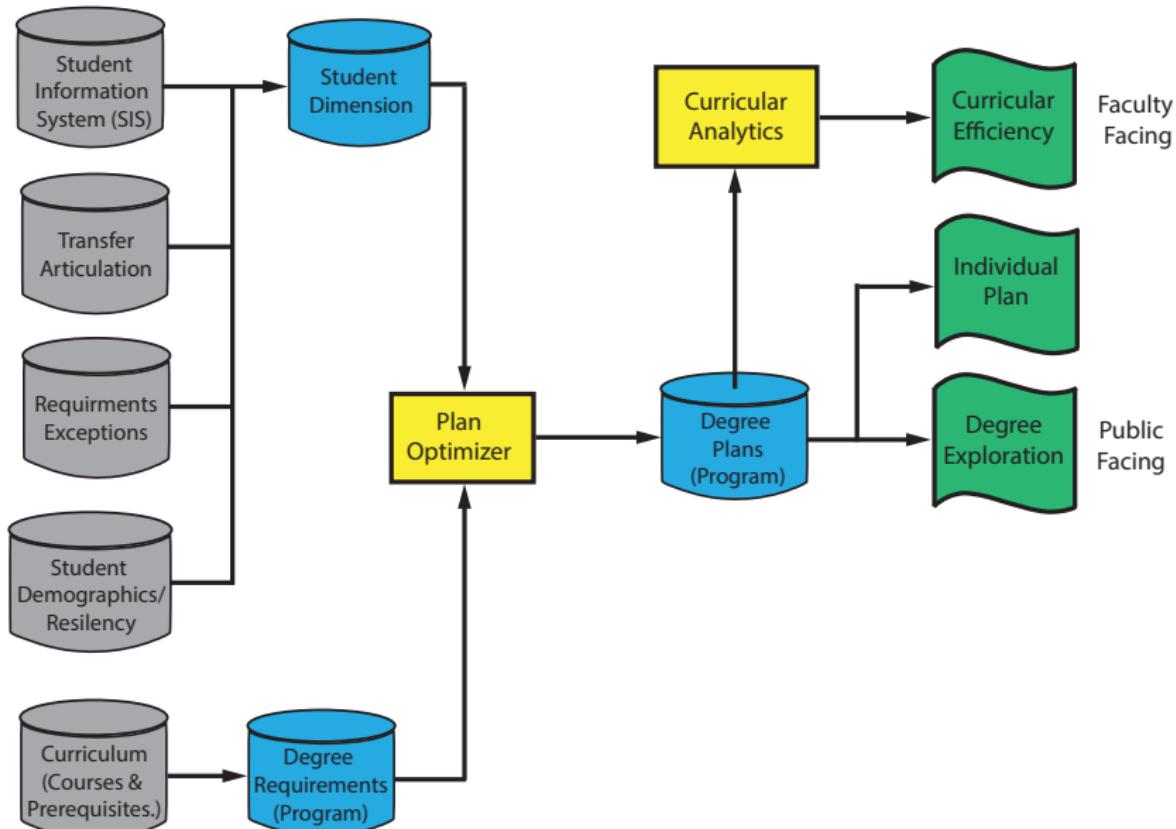
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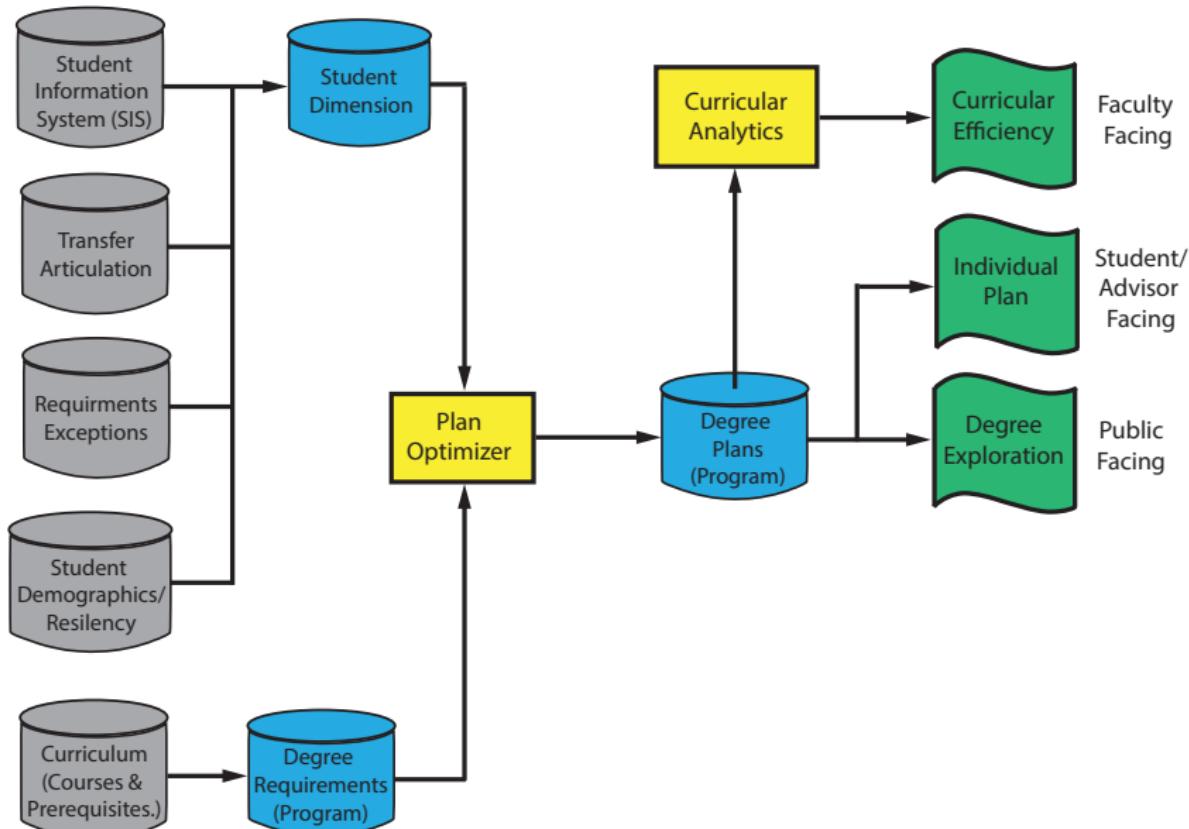
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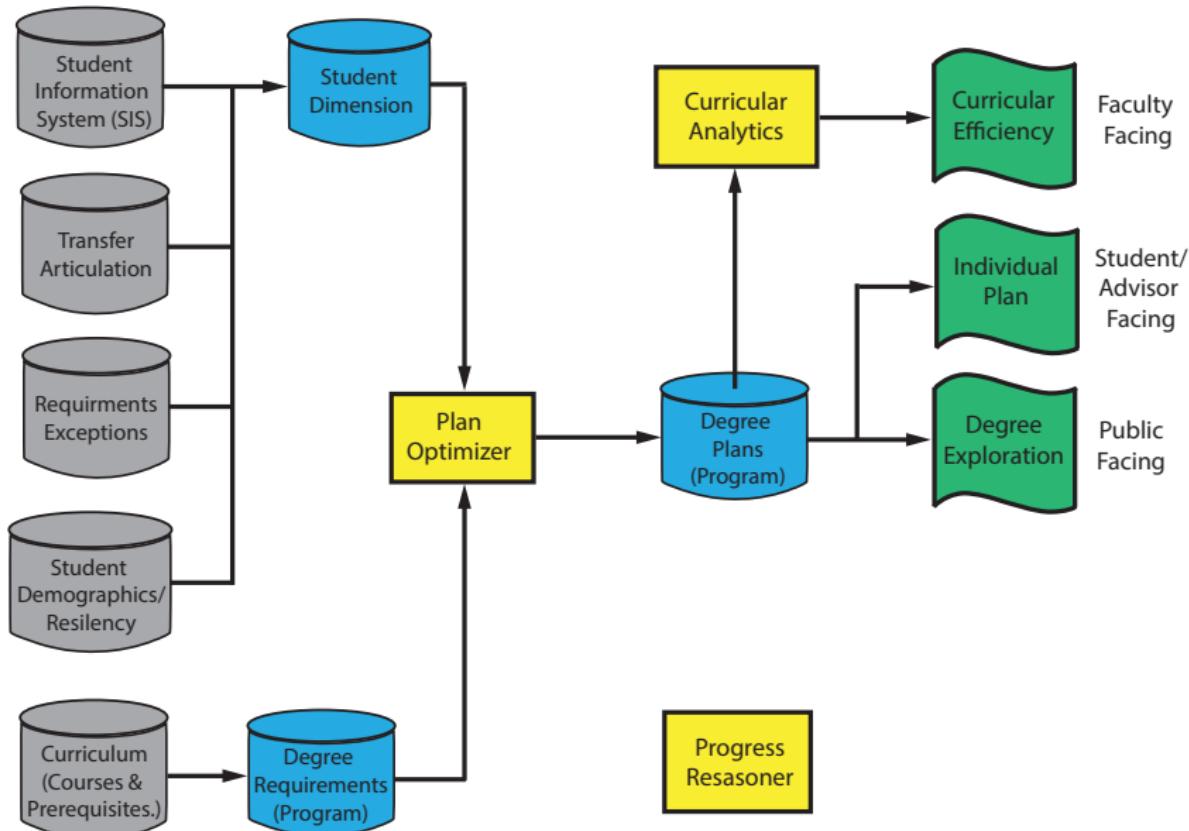
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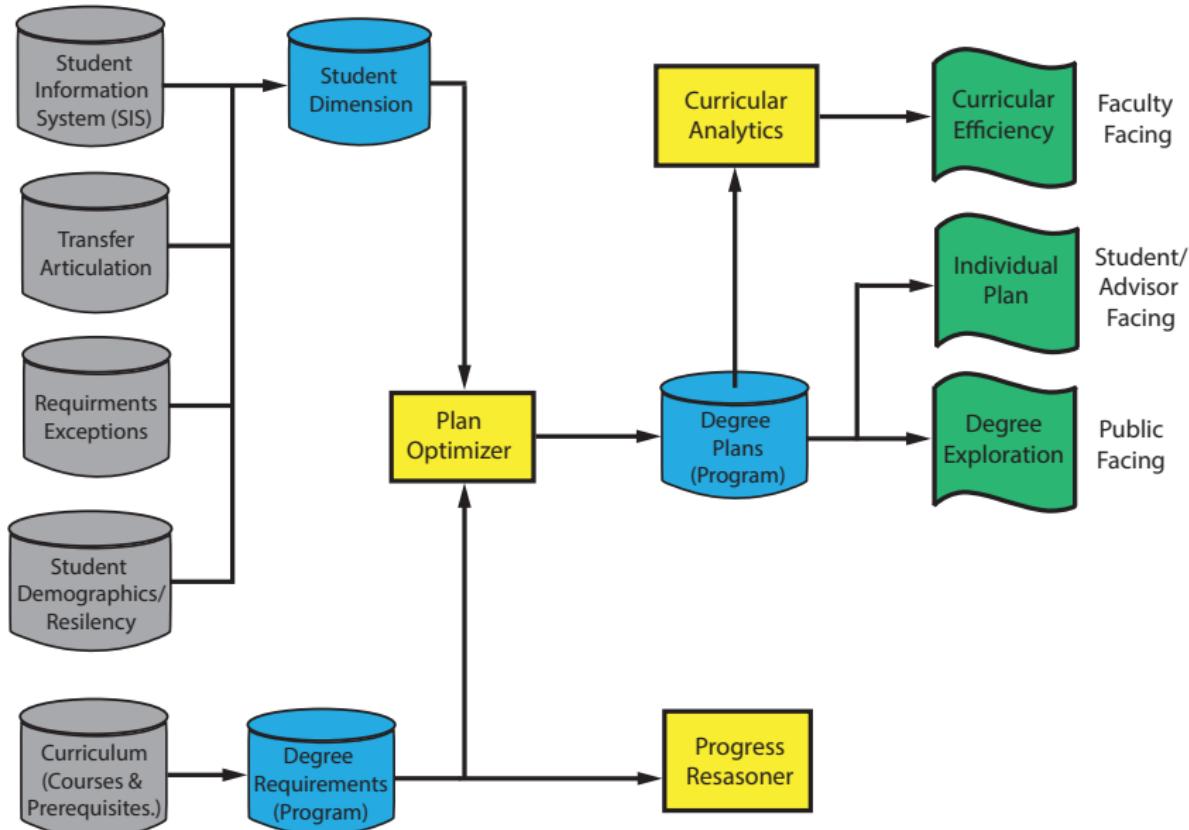
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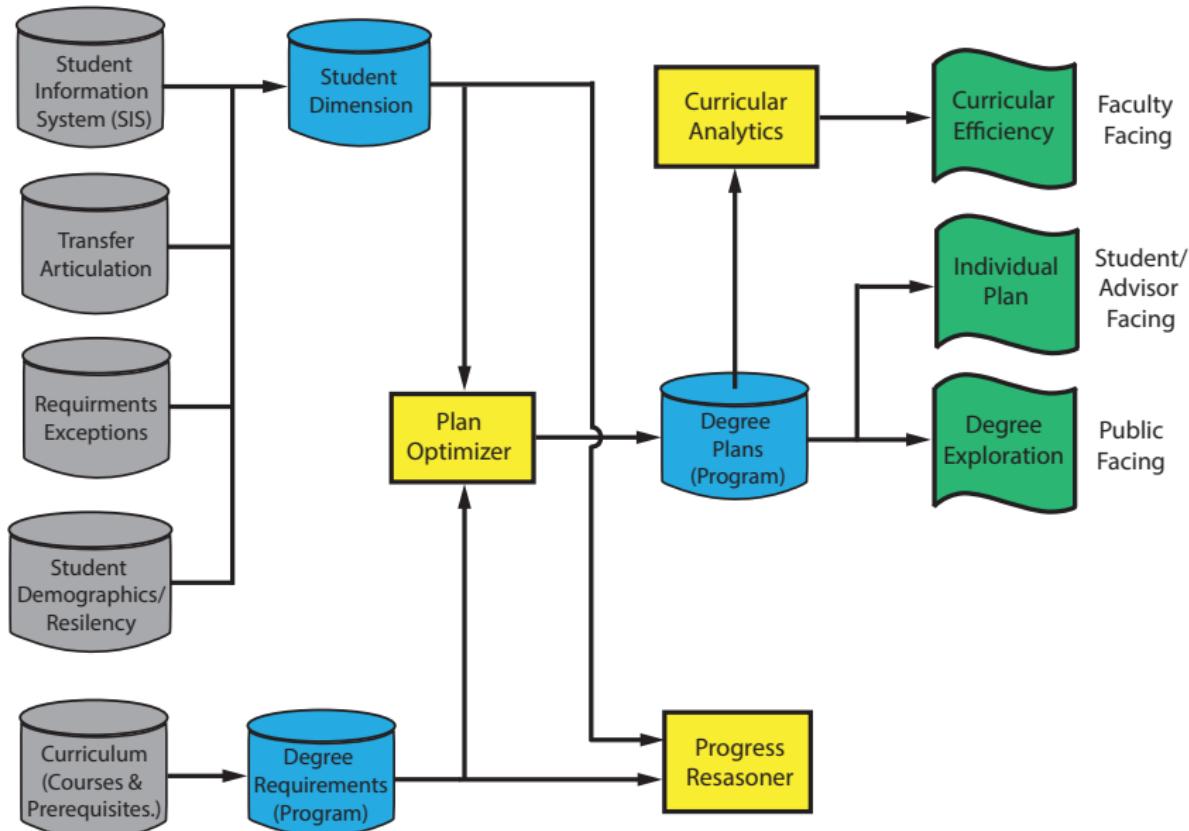
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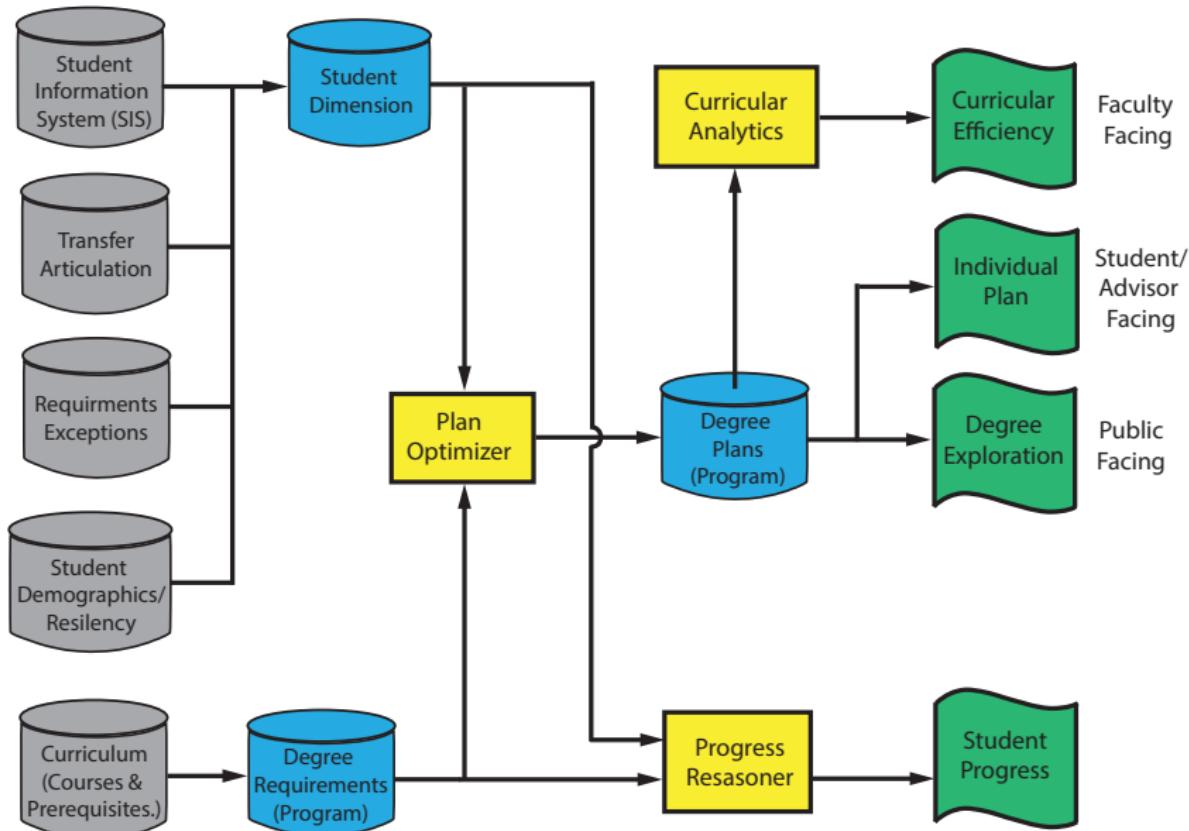
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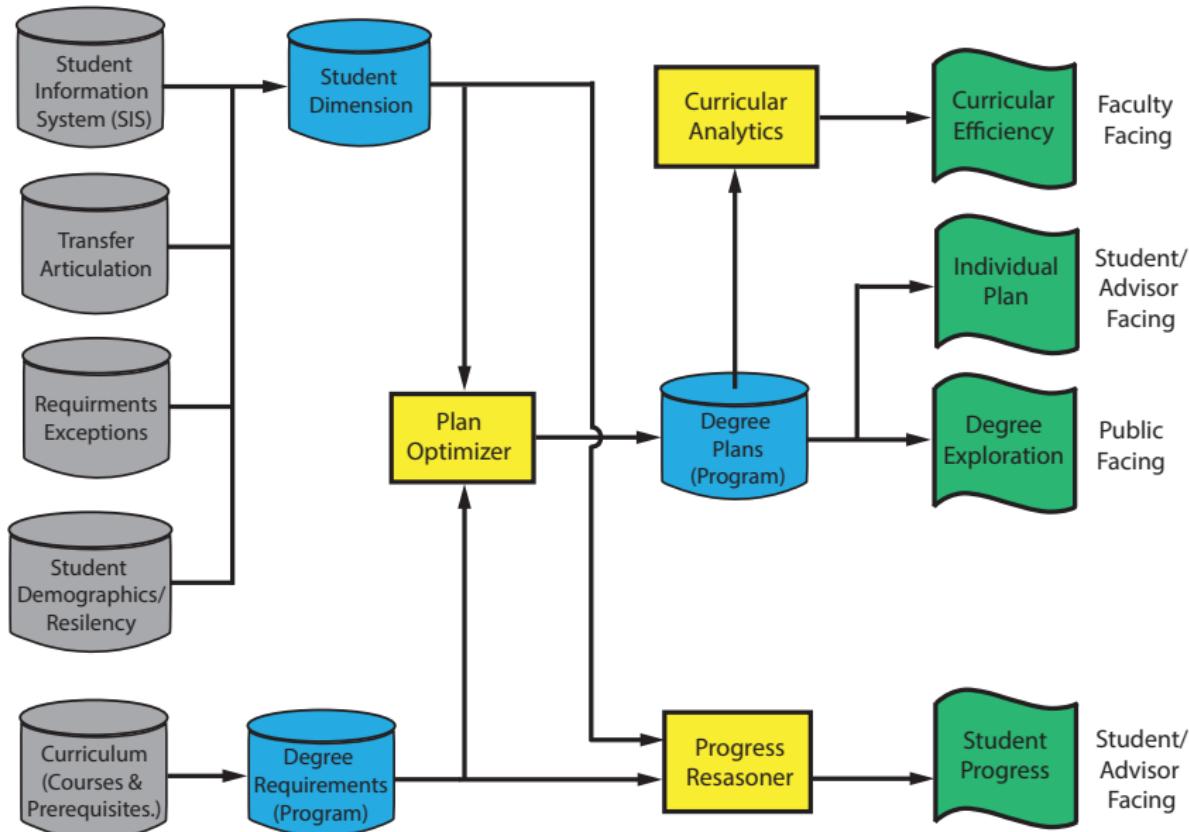
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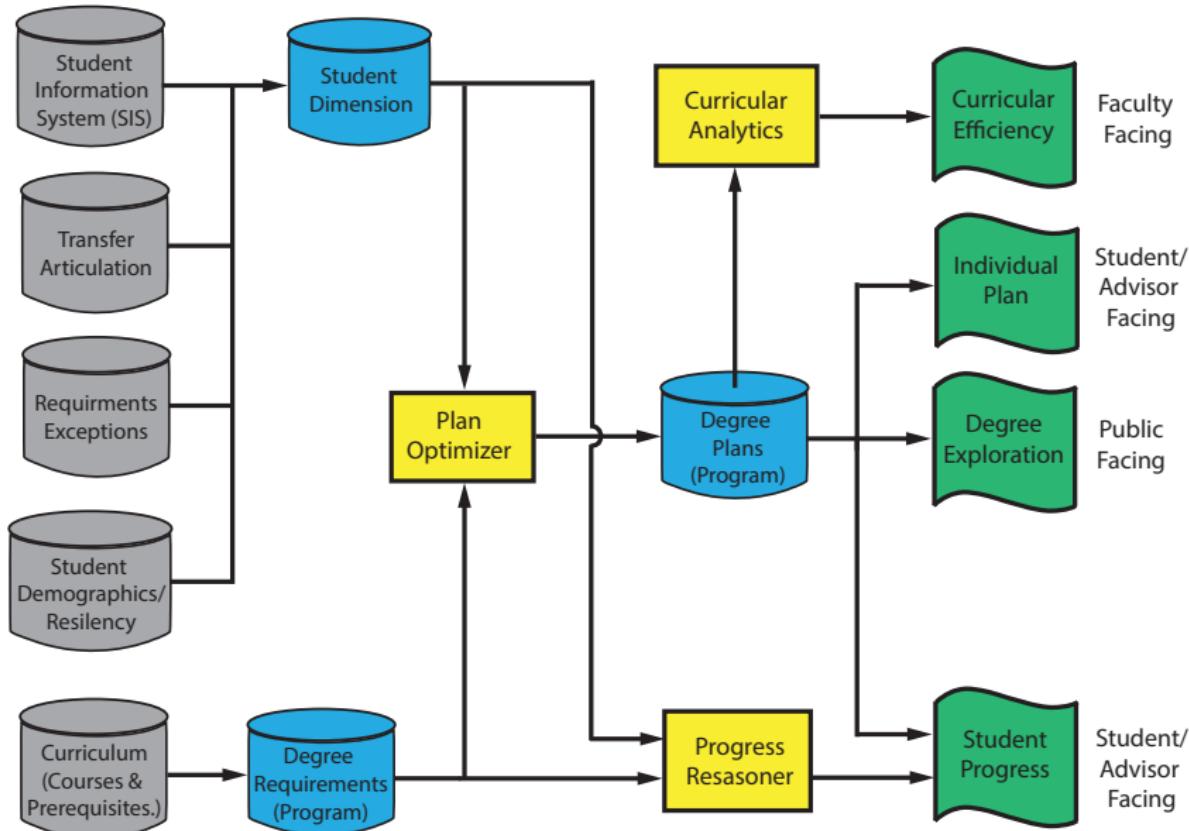
Analytics Journey



Analytics Journey



Analytics Journey



Analytics Journey

STUDENT ID: 1C-----B

MINOR: N/A

MAJOR: Computer Engineering

CONCENTRATION: N/A

ADMITTED TO PROGRAM

Fall 2010

GPA

2.77

ATTEMPTED CREDIT HOURS

213

COMPLETION

93%

This degree audit should be used for analysis and advising purposes only. This audit may contain errors, and should not be considered an official transcript.

EFFICIENCY RATING

53

CREDITS COUNTED TOWARDS DEGREE:

112

CREDITS NOT COUNTED TOWARDS DEGREE

101

REQUIREMENTS COMPLETED

ECON

Social and Behavioral Sciences

Mathematics

Foreign Language

ENGL 110 or (ENGL 111 and ENGL 112) or ENGL 113

PHYC 161L

PHYC 160

MATH 163

ECE 420

ECE 344L

ECE 340

ECE 330

ECE 206L

Fine Arts

Physical and Natural Sciences

Humanities

ENGL 219 or ENGL 220 or CJ 130 or PHL 156 or JHON 201

Tech Elective

PHYC 161

ENGL 219

ECE 440

ECE 419

ECE 331

ECE 314

ECE 213

ECE 238L

Analytics Journey

REQUIREMENTS NOT COMPLETED

• MATH 162

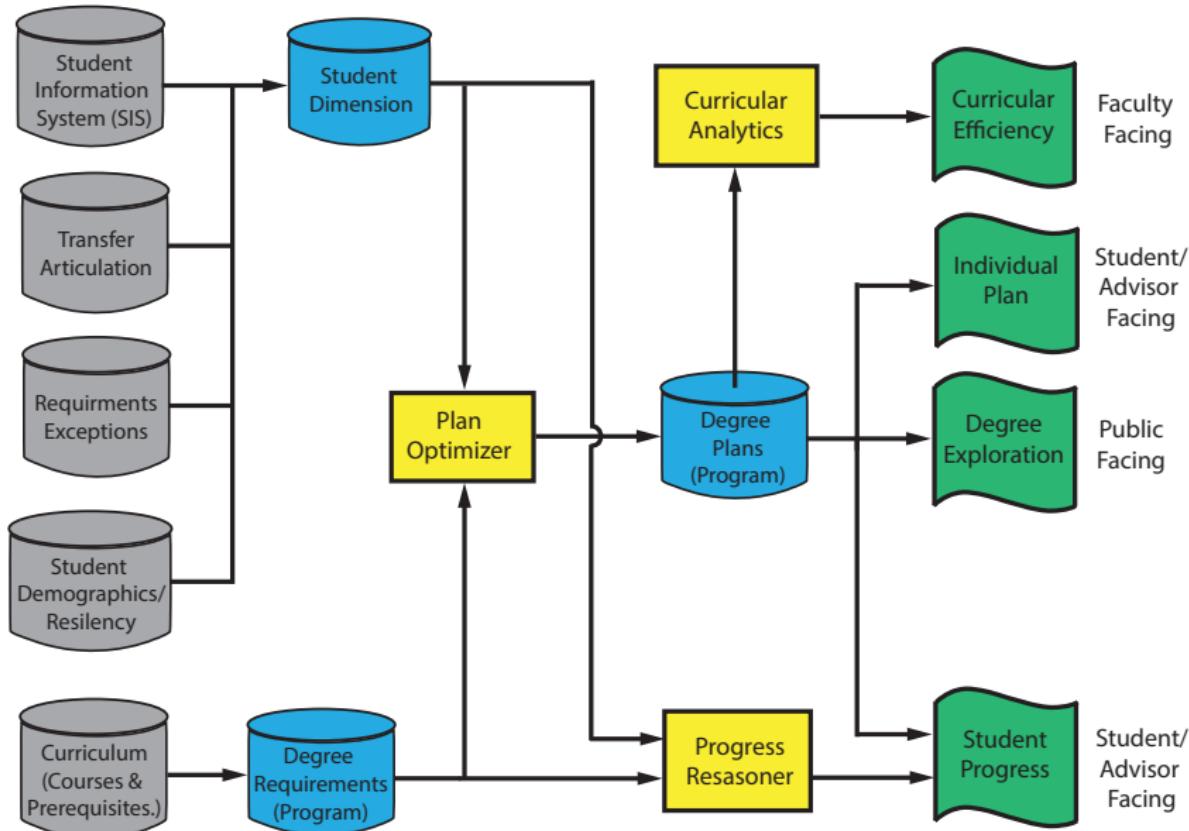
• ECE 300

• ECE 321L

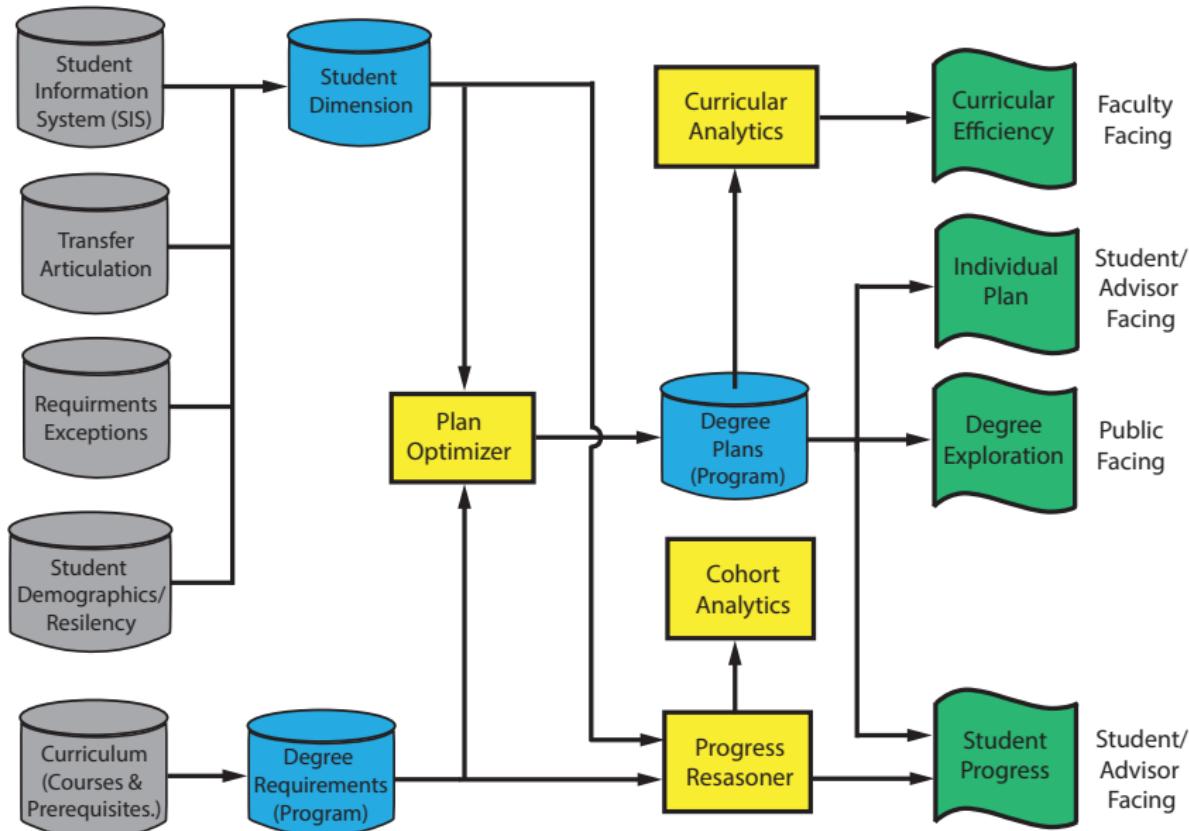
COURSES NOT COUNTED

CS 105L: A	Not applicable towards degree	UNIV 101: A+	Not applicable towards degree
THEA 130: A	Not applicable towards degree	MATH 123: C+	Not applicable towards degree
PENP 114: B-	Not applicable towards degree	PENP 101: A-	Not applicable towards degree
CS 151L: A	Not applicable towards degree	MATH 120: B-	Not applicable towards degree
PENP 115: A+	Not applicable towards degree	MATH 150: D	Grade Not Sufficient
ECOP 105: CR	Grade Not Sufficient	SPAN 212: F	Grade Not Sufficient
MATH 264: D+	Grade Not Sufficient	MATH 121: D	Grade Not Sufficient
ECE 213: IF	Grade Not Sufficient	PSY 105: C-	Grade Not Sufficient
PHYC 168: CR	Grade Not Sufficient	CHEM 111L: NC	Grade Not Sufficient
MATH 101: A	Transferred Course	MATH 150: WP	Withdraw
CHEM 111: WF	Withdraw	ECE 340: W	Withdraw
ECE 437: W	Withdraw	MATH 264: W	Withdraw
MATH 264: W	Withdraw	MATH 327: W	Withdraw
CS 152L: W	Withdraw	ECE 203: W	Withdraw
ENGL 102: WP	Withdraw	ARTH 101: W	Withdraw
MATH 327: W	Withdraw	MATH 121: WP	Withdraw
MATH 123: WP	Withdraw	ANTH 101: W	Withdraw
ECE 412: W	Withdraw	ECE 345: W	Withdraw

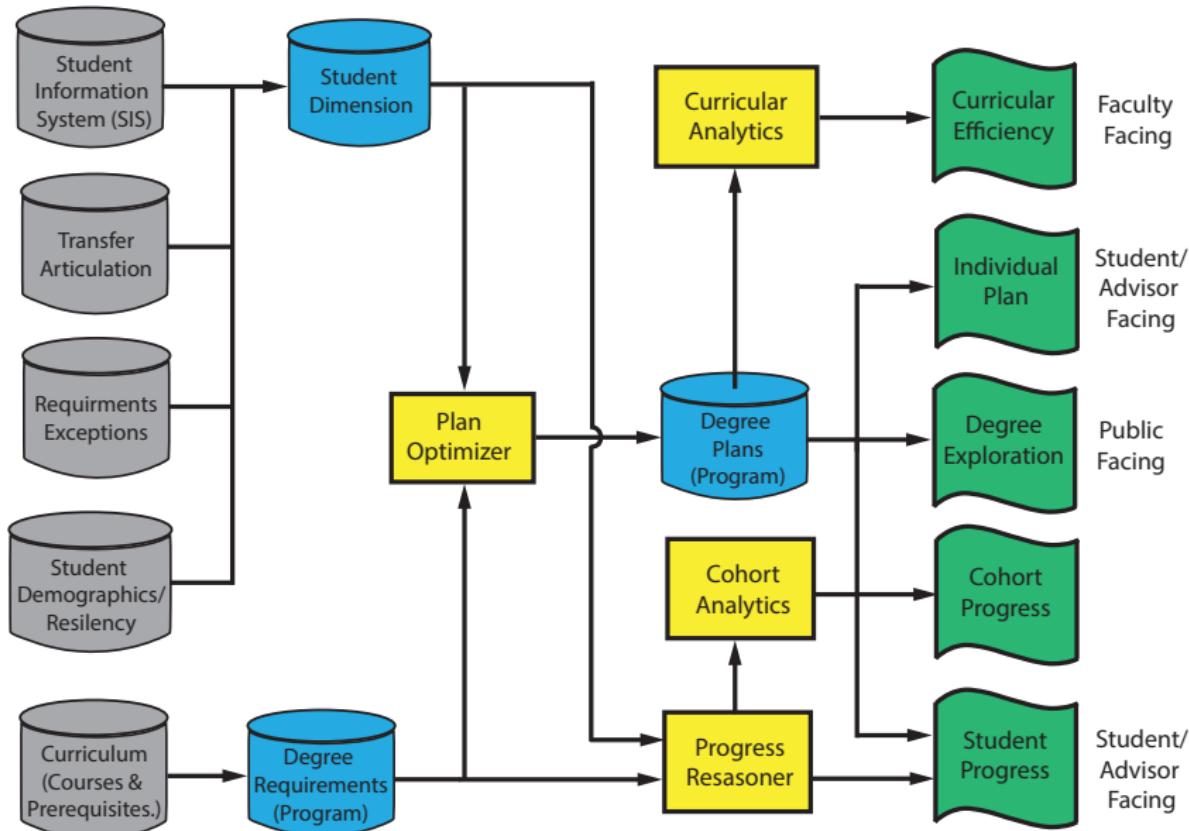
Analytics Journey



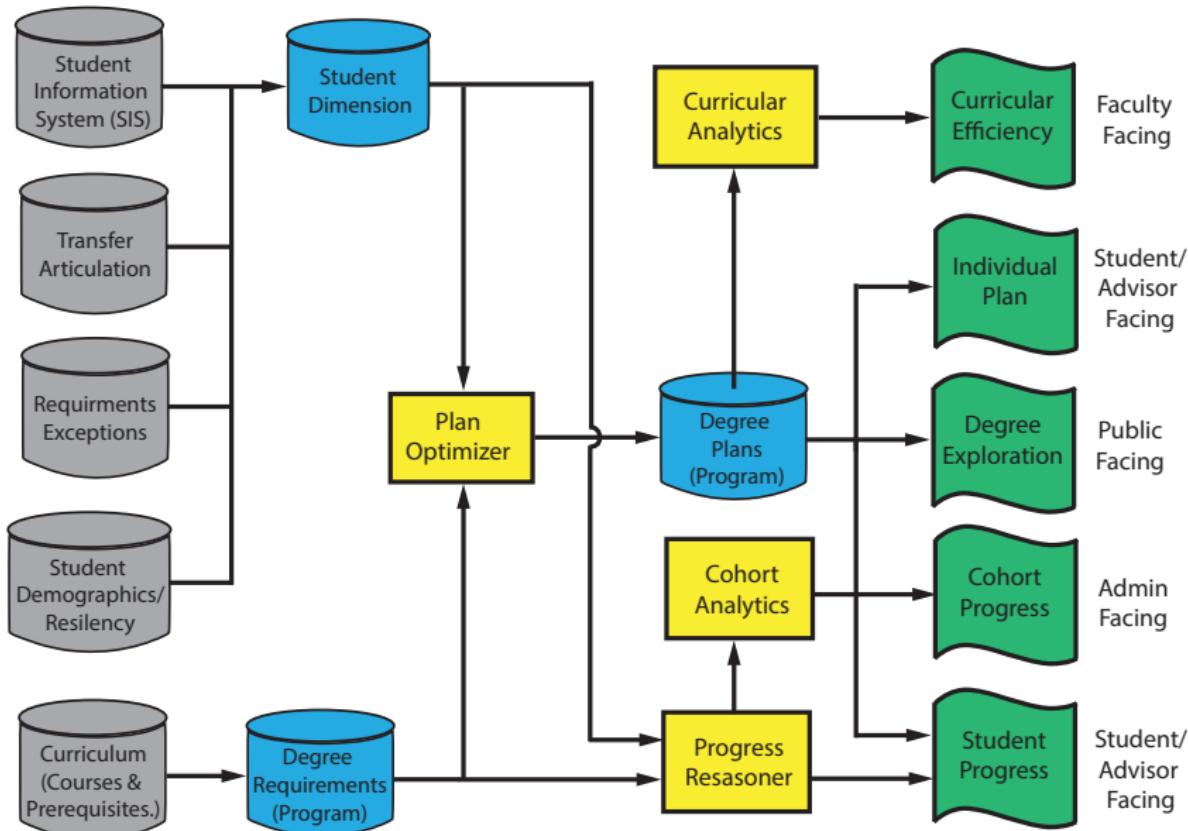
Analytics Journey



Analytics Journey



Analytics Journey



Analytics Journey

COLLEGE OF FINE ARTS

This dashboard is meant to be used for cohort analytics purposes only. As the data may contain errors, it should not be used as an official audit of student progress. All analytics are computed relative to the 2015-2016 academic year.

STUDENTS

456

AVERAGE GPA

3.46

AVERAGE CREDIT HOURS

110

AVERAGE COMPLETION

68%

EFFICIENCY RATING

80

Avg Credits Counted Towards Degree:

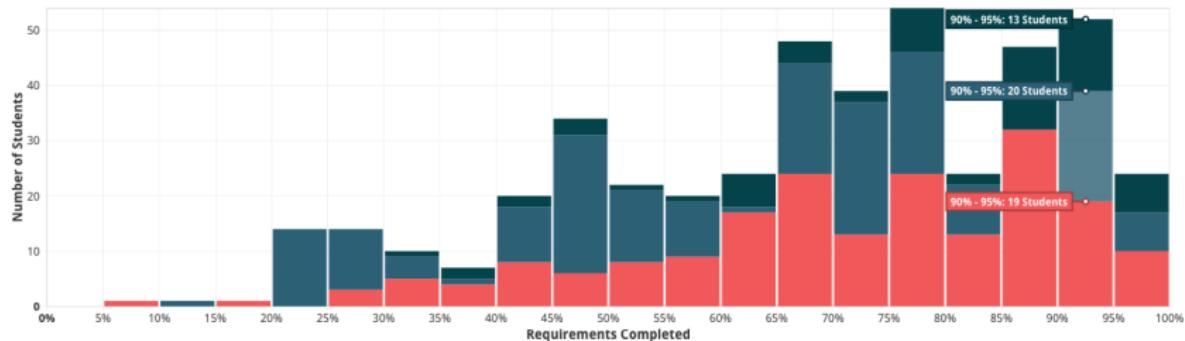
88

Avg Credits Not Counted Towards Degree

22

STUDENT PROGRESS HISTOGRAM

● Off Track Students ● On Track Students ● Students Ahead



Analytics Journey

SCHOOL OF ENGINEERING

This dashboard is meant to be used for cohort analytics purposes only. As the data may contain errors, it should not be used as an official audit of student progress. All analytics are computed relative to the 2015-2016 academic year.

STUDENTS
1006

AVERAGE GPA
3.46

AVERAGE CREDIT HOURS
124

AVERAGE COMPLETION
61%

EFFICIENCY RATING

61

Avg Credits Counted Towards Degree:

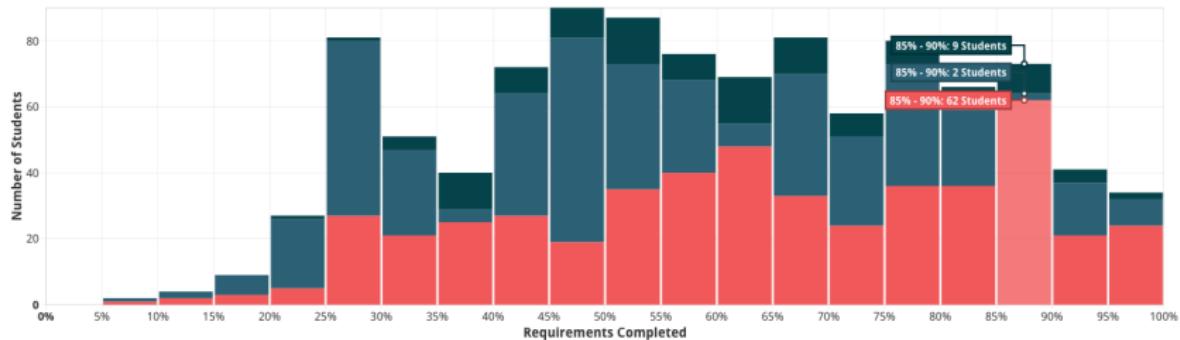
75

Avg Credits Not Counted Towards Degree

49

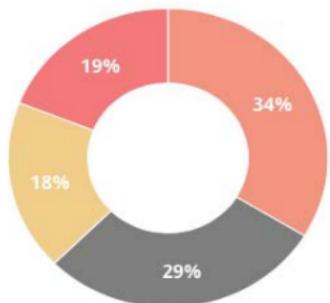
STUDENT PROGRESS HISTOGRAM

● Off Track Students ● On Track Students ● Students Ahead



Analytics Journey

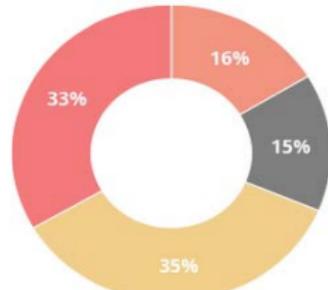
COURSES NOT COUNTED



Fine Arts

i

COURSES NOT COUNTED



Engineering

- Grade Not Sufficient
- Withdraws
- Transfer
- UNM

- Grade Not Sufficient
- Withdraws
- Transfer
- UNM

Analytics Journey

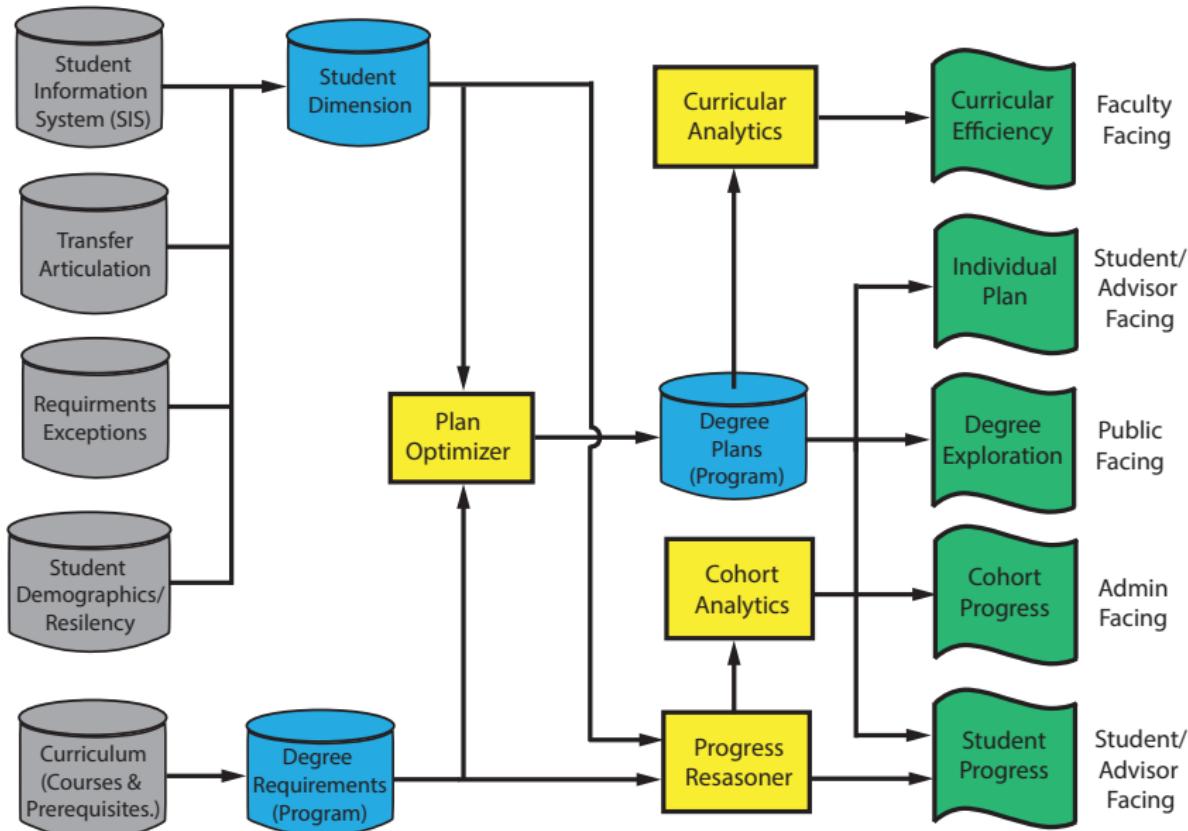
Grade Not Sufficient

Course	Count		Course	Count
MUS 101	75		PHYC 167	250
ISM 100	47		PHYC 168	149
ARTS 123	44		ECOP 105	130
MUS 214	24		MATH 163	115
HIST 101	19		MATH 264	109
ENVS 101	19		MATH 162	106
SOC 101	19		PHYC 161	77
MUSE 215	19		PHYC 160	71
DEV 100	10			--

Fine Arts

Engineering

Analytics Journey



Working Together

- We have received foundation funding to create a public benefit corporation that serves higher education:

Working Together

- We have received foundation funding to create a public benefit corporation that serves higher education:

“Analytics by academics for academics”

Working Together

- We have received foundation funding to create a public benefit corporation that serves higher education:

“Analytics by academics for academics”

- Supporting a grant aimed at providing student success analytics to minority-serving institutions.

Working Together

- We have received foundation funding to create a public benefit corporation that serves higher education:

“Analytics by academics for academics”

- Supporting a grant aimed at providing student success analytics to minority-serving institutions.
- If you'd like to collaborate:

idi.unm.edu

gregheileman@gmail.com

